Third Five-Year Review Report

Colesville Municipal Landfill Superfund Site

Broome County
Town of Colesville, New York

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

February 2010

SYMBOL --->	CNYRS	CNYRS	NYRB	ERRD	ERRD	ERRD		
SURNAME ->	JACOB	SINGERMAN	GARBARINI	SIVAK	LA PADULA	MUGDAN		
DATE -------->								

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FIGURE

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Acronyms Used in this Document	
ARAR	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Contaminants of Potential Concern
ESD	Explanation of Significant Differences
EPA	United States Environmental Protection Agency
gpm	gallons per minute
PRGs	Preliminary Remediation Goals
mg/kg	milligrams per kilogram
MCLs	Maximum Contaminant Levels
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Protection
O&M	operation and maintenance
PRPs	potentially responsible parties
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/ Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
TAGM	Technical and Administrative Guidance Memorandum
ug/l	micrograms per liter
VOC	volatile organic compound

Executive Summary

This is the third five-year review for the Colesville Municipal Landfill Superfund site, located in the Town of Colesville, Broome County, New York. Based on the review of the data for the last five years, it is concluded that the implemented actions at the site currently protect human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Colesville Municipal Landfill Superfund Site		
EPA ID *(from WasteLAN)*: NYD980768691		
Region: 2	**State:** NY	**City/County:** Town of Colesville/Broome 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 30, 2004
Has site been put into reuse? ☐ YES ■ NO ☐ N/A	

REVIEW STATUS	
Lead agency: ☐ EPA ■ State ☐ Tribe ☐ Other Federal Agency _____	
Author name: George Jacob	
Author title: RPM	**Author affiliation: USEPA**
Review period:** 4/2005 to 4/2010	
Date(s) of site inspection: 11/10/2009	
Type of review: ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion ☐ Policy ■ Statutory	
Review number: ☐ 1 (first) ☐ 2 (second) ■ 3 (third) ☐ Other (specify)_____	
Triggering action: ☐ Actual RA Onsite Construction at OU # __ ☐ Actual RA Start at OU# ☐ Construction Completion ■ Previous Five-Year Review Report ☐ Other (specify)	
Triggering action date *(from WasteLAN)*: 4/19/2005	
Due date *(five years after triggering action date)*: 4/19/2010	
Does the report include recommendation(s) and follow-up action(s)? ■ yes ☐no **Is human exposure under control?** ■ yes □ no **Is contaminated groundwater under control?** ■ yes □ no □ not yet determined **Is the remedy protective of the environment?** ■ yes □ no □ not yet determined **Acres in use or available for use:** **restricted:** 35 **unrestricted:** 0	

** [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.

Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls

This site has ongoing operation, maintenance, and monitoring activities as part of the selected remedy. As was anticipated by the decision documents, these activities are subject to routine modification and adjustment.

Issues, Recommendations, and Follow-Up Actions

Institutional controls prohibiting the installation of groundwater wells on the site and in downgradient areas and to protect the integrity of the cap and extraction wells need to be put into place.

The subsurface stone collection trench and drainage layer in the area of the spring along the North Stream, which was installed to prevent the contaminated spring water from exfiltrating above the land surface, was damaged during a flood event in 2006. The collection trench and drainage layer were replaced with a riprap wall, which is not preventing the contaminated spring water from exfiltrating above the land surface. Measures need to be taken to prevent the exfiltration of the leachate, such as installing extraction wells on the landfill boundary above the North Seep.

Protectiveness Statement

The implemented actions at the site protect human health and the environment in the short-term; however, in order for the site to be protective in the long-term, institutional controls need to be implemented. Currently, there are no exposure pathways that could result in unacceptable risks and none are expected, as long as the site use does not change and the engineered and access controls that are currently in place continue to be properly operated, monitored, and maintained.

FIVE-YEAR REVIEW REPORT

I. INTRODUCTION

This is the third five-year review for the Colesville Municipal Landfill Superfund site, located in the Town of Colesville, Broome County, New York. This five-year review was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) George Jacob. The review was conducted pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §9601 *et seq.* and 40 CFR 300.430(F)(4)(ii) and in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The purpose of five-year reviews is to ensure that implemented remedies protect public health and the environment and that they function as intended by the site decision documents. This report will become part of the site file.

A five-year review is required at this site due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

In accordance with Section 1.3.3 of the five-year review guidance, a subsequent statutory five-year review is triggered by the signing date of the previous five-year review report. The previous five-year review was signed on April 19, 2005.

Based upon this five-year review, it has been determined that the groundwater contamination at the site is under control and the implemented actions at the site currently protect human health and the environment.

II. SITE CHRONOLOGY

Table 1(attached) summarize the site-related events from discovery to construction completion.

III. BACKGROUND

Site Location

The Colesville Landfill site is located in the Town of Colesville, Broome County, New York. The property on which the landfill is situated is bounded by East Windsor Road to the south and by unnamed tributaries of the Susquehanna River to the west-northwest (North Stream) and to the east (South Stream) (see Figure 1). The nearest residential development is Doraville, located approximately a mile to the southeast of the site.

Physical Characteristics

The Colesville Landfill Superfund site is characterized as rural and includes large tracts of undeveloped woodlands, as well as agricultural tracts and scattered residential parcels. Of the 113 acres on which the property is situated, the landfill occupies approximately 35 acres. The property's topography ranges from approximately 1,400 feet above mean sea level in the east to about 970 feet above mean sea level in the west.

Surface water drainage at the site is via two tributaries of the Susquehanna River—the North Stream and the South Stream. The North Stream, located to the north and west of the landfill, flows southwesterly to the Susquehanna River. To the east and south of the landfill is the South Stream, which flows to the south-southwest into a low-lying wet area. Both tributaries join the Susquehanna River approximately 0.5 miles above Doraville.

The Susquehanna River is classified as Class B surface water in the vicinity of the site. Class B waters are suitable for both primary[1] and secondary[2] contact recreation, as well as for fish propagation. The North Stream and South Stream are Class C and D waters, respectively. These waters are suitable for secondary contact recreation and fish propagation only.

Existing flood insurance maps (Federal Emergency Management Agency, 1983) indicate that no portions of the site are located in either the 100- or 500-year flood zone.

Vegetation patterns at the site are a mixture of herbaceous field, weed, and grass species. Both open-field and forested habitats characterize the surrounding area. These habitats support a large variety of avian and mammalian species. No New York State Department of Environmental Conservation (NYSDEC) Significant Habitat Areas are found on-site, although the site is located within the range of several migratory endangered or threatened species. The predominant aquatic species found in the Susquehanna River include small mouth bass, rock bass, and white suckers.

The nearest homes to the landfill are located to the south and southeast along East Windsor Road. The home closest to the landfill, which was at a distance of approximately 380 feet, was purchased by Broome County and was demolished. Another home, located approximately 500 feet from the landfill, is now vacant. Two other homes are located approximately 640 feet from the landfill.

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[1] Primary Contact Recreation—recreational activities where the human body may come in direct contact with water to the point of complete body submergence (i.e., swimming, diving, water sports, and surfing).

[2] Secondary Contact Recreation—recreational activities where contact with water is minimum and where ingestion of water is not probable (*i.e.*, fishing and boating).

Site Geology/Hydrogeology

Glacial outwash deposits at the site consist of a heterogeneous mixture of gravel, sand, clay and silt. The average hydraulic conductivity of these materials is approximately 0.3 ft/day. Water moving within the glacial outwash aquifer beneath the landfill is part of a shallow groundwater subsystem that discharges into nearby surface-water bodies. In this type of hydrogeologic setting, essentially all of the areal recharge to the glacial outwash aquifer moves horizontally because of the dense glaciolacustrine clay confining unit that underlies the glacial outwash aquifer. The direction of groundwater flow at the Colesville Landfill site is toward the west and southwest, discharging to the North Stream and Susquehanna River. Although groundwater is present in the till and glaciolacustrine clay, the low permeabilities of these units limit their potential for groundwater flow. A very small portion of the base flow to the Susquehanna River is derived from groundwater flow moving upward from the bedrock aquifer, through the glaciolacustrine clay into the overlying glacial outwash aquifer, where it ultimately seeps into the Susquehanna River.

Land and Resource Use

The area surrounding the site includes large tracts of undeveloped woodlands, as well as agricultural tracts and scattered residential parcels.

Many of the residents of the Town of Colesville use private water supply wells. These wells utilize groundwater from both shallow and deep aquifers. Other homes utilize groundwater obtained from springs.

The home closest to the landfill is located approximately 500 feet from the landfill; the home is currently vacant. Two other homes are located approximately 640 feet from the landfill. Since the Susquehanna River is downgradient of these properties, no other properties are potentially impacted by the site.

History of Contamination

Waste disposal operations at the landfill commenced in 1969. The landfill was owned and operated by the Town of Colesville between 1969 and 1971. Broome County purchased the landfill in 1971, and operated it until 1984 when it closed.

The landfill was primarily used for the disposal of municipal solid waste, although drummed industrial wastes from various sources were also disposed of between 1973 and 1975. Operational records indicate that these drummed wastes consisted of aqueous dye waste and organic solvent waste. Known waste constituents included benzene, cyclohexane, acetone, isopropyl alcohol, methanol, ethanol, n-hexane, toluene, xylene, dimethyl ether, zinc, aluminum, iron, tin sulfate, and chloride. In practice, drummed wastes were randomly co-disposed with the municipal solid wastes and disposed of in segregated areas. The drums were either buried intactly, or were punctured and crushed prior to burial.

The landfill contains approximately 468,000 cubic yards of co-disposed waste.

Initial Response

The site was proposed for inclusion on the Superfund National Priorities List (NPL) in October 1984; it was listed on the NPL in June 1986. NYSDEC was designated the lead agency for this site.

In 1983, samples collected by the Broome County Health Department from residential wells in the vicinity of the site indicated that the Colesville Landfill was contaminating the groundwater beneath and in the immediate vicinity of the site. The sample results prompted the Broome County Department of Public Works to install carbon filters on the affected residences, to conduct a quarterly residential well monitoring program, and to perform two investigative studies of the Colesville Landfill. These studies were performed by Wehran-New York, Inc. (Wehran) in 1983 and 1984.

Wehran's 1983 study indicated that the groundwater quality in the vicinity of the Colesville Landfill demonstrated a strong indication of contamination by landfill leachate. Volatile organic levels, measured as total volatile organics, ranged from 48 to 2,800 micrograms per liter (µg/l) within and around the landfill. Residential wells ranged from 32 µg/l to 415 µg/l, expressed as total volatile priority pollutants.

Wehran's 1984 investigation confirmed the findings of the 1983 study with respect to the immediate landfill vicinity. Total volatile priority pollutant concentrations ranged from "not detected" in upgradient monitoring wells to 7,795 µg/l immediately downgradient. Contamination was confined, primarily, to the upper portions of the glacial outwash aquifer that underlies the site.

Basis for Taking Action

In 1988, Wehran completed a remedial investigation (RI) at the site on behalf of the Broome County Department of Public Works and GAF Corporation, the Potentially Responsible Parties (PRPs), pursuant to an Order on Consent (Index No. T010687) issued by NYSDEC.

The RI found that the landfill was releasing low levels of VOCS into the groundwater. In general, five VOCS, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, trans-1,2-dichloroethene and benzene, were the major contaminants in the contaminant plume. The risk assessment concluded that exposure to the chemicals identified at the site could result from the consumption of contaminated well water or the inhalation of VOCs present in the water.

In 1990, Wehran completed a confirmatory sampling program which confirmed the findings of the 1988 RI.

In December 1990, Wehran completed a feasibility study (FS) report, which presented an analysis of the potential alternatives for the remediation of contamination observed at the site.

IV. REMEDIAL ACTIONS

Remedy Selection

Based upon the results of the RI/FS, in 1991, EPA signed a ROD for the site, calling for, among other things:

- Installation of a multimedia cap on the landfill;
- Installation of a leachate collection system;
- Installation of groundwater extraction wells to contain the groundwater contamination;
- Collection and treatment of contaminated groundwater from beneath and downgradient of the landfill;
- Conveyance of the collected leachate and contaminated groundwater via the sewer system to a local wastewater treatment facility;
- Imposition of property deed restrictions, if necessary, to prevent the installation of drinking water wells at the site and to restrict activities which could affect the integrity of the cap, monitoring wells, and extraction wells; and
- Provision of new wells for affected residents located in the vicinity of the site.

Remedy Implementation

Pursuant to the above-referenced Order on Consent with NYSDEC, Weharn, on behalf of the PRPs, began the engineering design for the selected remedy in the spring of 1991. During the initial stages of the design, the PRPs' consultant performed extensive field work to collect additional data for the groundwater portion of the remedial design. By June 1993, it was apparent that there were technical issues related to the groundwater extraction and treatment system that would not be easily or promptly resolved. It was, therefore, decided that the landfill cap design and the alternate water supply (double-cased deep wells) design should be completed separately from the groundwater extraction and treatment system design to allow the capping of the landfill and alternate water supply components of the remedy to proceed. In 1994, Wehran, on behalf of the PRPs, completed the engineering design for the capping of the landfill and wetland restoration (creation of a new wetland to replace the three small wetland areas on the landfill's surface); the capping of the landfill and wetland restoration, performed by Tug Hill Construction Inc., was completed in October 1995.

An alternate water supply well design(deep wells), which was prepared by Wehran, was approved by the State in 1995. The implementation of the design was delayed, however, while Broome County attempted to purchase the five affected properties and to place deed restrictions preventing the installation and use of groundwater wells on the properties so that there would be no drinking water receptors. The County purchased three of the five properties. All three of the purchased properties are now vacant. Two of the wells on these properties have been decommissioned. The well on the third property was replaced with a new bedrock well in the early 1990s. Of the two properties that the County has not purchased, one of them is vacant and the other contains two occupied structures. On the occupied property, the County decommissioned an old well and a surface water supply system and installed two new bedrock wells (one for each structure).

Based upon design-related aquifer tests conducted at the site, it was determined that extracting contaminated groundwater at the landfill, as called for in the ROD, would not likely be an effective means of remediating the groundwater at the source in a reasonable time frame. Specifically, the aquifer tests determined that the aquifer near the landfill has a low permeability, which would severely limit the area of influence of the extraction wells and would allow the groundwater to be pumped at only a very low rate (0.25 to 0.5 gallon per minute). Such conditions would necessitate the installation of an inordinate number of extraction wells. This conclusion led to an evaluation of alternative groundwater technologies and the performance of a pilot-scale study to evaluate the effectiveness of one of the more promising technologies, enhanced reductive dechlorination. This process involves injecting the contaminated groundwater with an easily degradable carbohydrate solution (*i.e.*, molasses), which provides excess organic carbon that promotes microbial activity in the aquifer, enhancing the breakdown of chlorinated VOCs. Based upon the results of the pilot study, which showed a significant decline in VOC concentrations, it was concluded that this technology, in combination with the

installation of downgradient extraction wells (as called for in the ROD), offered the most technically feasible approach to restoring groundwater quality in a reasonable time frame[3].

In January 2001, while the groundwater remedy was under construction, GAF Corporation declared bankruptcy. Subsequently, NYSDEC and Broome County negotiated a new State Order under which the remaining work was completed.

The groundwater management system, constructed by Clean Earth Technologies, Inc., as a subcontractor to ARCADIS, became operational in September 2002. It consists of 17 automated reagent injection wells, three groundwater recovery wells, and an on-site groundwater treatment system. Molasses injections are performed automatically once every four weeks.

In April 2000, during an inspection of the site performed as part of the five-year review process, in the vicinity of the landfill, EPA inspected a spring and a low-lying wet area that were contaminated with site-related pollutants that exceeded NYSDEC's Ambient Water Quality Values. The source of the low-lying wet area is groundwater discharging upward through a vertical, three-foot diameter concrete structure that extends approximately 2.5 feet below the ground surface. The concrete structure appears to have been placed there to enhance the spring as a source of water. Until the contamination was detected, the opening of this structure was partially buried and obscured by dense vegetation. Since contaminated water from the spring and the low-lying wet area could potentially discharge to nearby streams, remedial measures to address these areas were undertaken in September 2003 and July 2004, respectively. The remedy for the low-lying wet area consisted of a sand filter and a granular activated carbon unit that were placed in the concrete structure (a cover was placed over the top of the structure). The water then flows through a horizontal 4-inch diameter drainage pipe running through the side of the concrete structure. A riprap-lined outlet structure to prevent erosion was installed at the discharge point of the drainage pipe. The remedy for the contaminated spring along the North Stream consisted of the installation of a subsurface stone collection trench and drainage layer in the area of the spring to prevent the contaminated spring water from exfiltrating above the land surface. Riprap was placed between the stream and the collection trench to protect the integrity of the trench and infiltration bed during high water conditions. The contaminated groundwater that is the source of the spring is being treated with upgradient molasses injections near the landfill. These actions, which were performed by ARCADIS, were documented in a July 2004 ESD.

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[3] The change to the remedy was documented in a September 2000 Explanation of Significant Differences (ESD).

Institutional Controls Implementation

The ROD called for the imposition of property deed restrictions to prevent the installation of drinking water wells at the site and to restrict activities which could affect the integrity of the cap, monitoring wells, and extraction wells. Since the site property is municipally-owned, NYSDEC has not required the County to obtain a property deed restriction. At this time, NYSDEC and EPA agree that institutional controls need to be implemented. The County is currently seeking to place deed restrictions on all five of the affected properties to prevent the installation of groundwater wells. The County is also seeking to place restrictions on the landfill property to protect the integrity of the cap, monitoring wells, and extraction wells.

System Operations/Operation and Maintenance/Monitoring

To maintain the integrity and effectiveness of the cap, routine operation and maintenance (O&M) activities are necessary. The inspection/maintenance plan for the cap calls for regular inspection and evaluation of the cap, mowing the vegetation during the growing season, and fence maintenance. Repairs are to be made to the cap, as necessary, to control the effects of settling, subsidence, erosion or other events, and to prevent run-on from eroding or otherwise damaging the final cover. The inspection/maintenance plan has been modified to incorporate long-term groundwater monitoring, the molasses injections, the O&M of the groundwater extraction and treatment facility, and the maintenance of the passive treatment system placed in the concrete structure (granular activated carbon replacement) based upon post-treatment sampling results.

The site is inspected on a quarterly basis as follows:

- The site is inspected for debris, litter and/or waste.
- The landfill cap is inspected for vegetation loss due to erosion or poor grass growth. Annual ground inspections at the beginning of each summer also note the status of woody plant species on the landfill surface and side slopes.
- The landfill cap is inspected for settlement, ponding, and animal borrows.
- The gas venting pipes are inspected for damage.
- The site access gate and fence are inspected for operational locks and vandalism.
- The culverts, drainage ditches, and level spreaders are inspected for sediment buildup or erosion.
- The groundwater monitoring wells are inspected for operational locks, damage, and vandalism.

The subsurface stone collection trench and drainage layer in the area of the spring along the North Stream, which was installed in 2004 to prevent the contaminated spring water from exfiltrating above the land surface, was damaged during a flood event in May 2006. The

collection trench and drainage layer were replaced with a riprap wall, which is no longer preventing the contaminated spring water from exfiltrating above the land surface. The leachate that is exfiltrating above the land surface is creating a "yellow boy" condition in the stream. "Yellow boy" is composed of iron hydroxide and is created by iron-fixing bacteria feeding on the highly oxidized metallic salts in the landfill leachate. It coats the streambed and creates toxic conditions in stream ecosystems. It appears that the dilution power of the stream is sufficient to ameliorate the yellow boy before it extends more than 50 feet downstream, however. ``

Two small, low-lying areas of the cap where standing water was observed need to be filled and regarded.

The groundwater extraction and treatment design, as modified by the 2000 ESD, appears to be lowering contaminant levels close to the landfill boundary. The original extraction and treatment design was modified due to the fact that hydraulic conductivities in the aquifer system were too low to create a hydraulic boundary. Instead, the extraction wells located adjacent to the landfill were converted to molasses injection wells and contaminant mitigation is achieved through bioattenuation. Only two of the extraction wells continue to be pumped, and the treated water is used in the mixing and injection of molasses. Other electron donors may be as effective as molasses and might offer cost savings.

The groundwater extraction and treatment system O&M, injections of molasses, inspections, landfill maintenance, sampling, monitoring, data evaluation, and reporting costs are approximately $180,000 on an annual basis; these costs are broken down in Table 2 (attached).

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW REPORT

The previous five-year review, which was completed on April 19, 2005, noted that a seep was observed on the south side of the landfill, which could potentially overflow to the South Stream. Since a seep at this location has not been observed previously, the five-year review suggested that it was possible that the seep was attributable to heavy rains prior to the site inspection. The five-year review recommended that if the seep still existed, it should be sampled, and if the sampling shows that it is contaminated, it needed to be remediated. While the seep was not observed during semi-annual inspections conducted since the last five-year review, it reappeared in the 2010 five-year review inspection. Hence further inspection and sampling are warranted as recommended before.

The five-year review also noted that standing water was observed at two locations on the cap, recommending that these areas be filled and regraded. Based on these recommendations, Broome County initiated studies to evaluate the depressed area of the landfill. In August 2005, a field investigation was conducted by C&S Engineers in which the geomembrane liner was exposed in six locations of the depressed area, and one location outside of the depressed area for baseline analysis. The study concluded that there were no apparent signs of stress or tension in the geomembrane liner and no signs of undue wear or damage were observed. However, corrective measures were not implemented to provide positive surface water drainage. Based on assurances from Broom County, the corrective measures will be completed by August 2010.

The five-year review noted that two downgradient extraction wells showed an increase in vinyl chloride concentrations in 2003 and subsequent data showed that concentrations in these wells were falling. The five-year review recommended continued monitoring for vinyl chloride and its biodegradation products in wells downgradient of the injection wells to ensure that the chemicals transformed into more toxic compounds by the injection system are not moving off-site. Vinyl chloride and its degradation products were monitored quarterly in key wells within the anaerobic bioremediation zone and quarterly or annually at key wells located downgradient of the anaerobic bioremediation zone. The data indicate that the anaerobic bioremediation zone is completely degrading chlorinated volatile organic compounds to final end products (i.e., ethene/ethane). The data also indicate that incomplete dechlorination byproducts (i.e., vinyl chloride) are not increasing at downgradient monitoring locations.

Since the maximum concentration of trichloroethylene found in a downgradient well was above the vapor intrusion screening value during two sampling events, the five-year review recommended that subslab soil gas samples be collected from downgradient homes to evaluate the potential for vapor intrusion. A soil vapor evaluation was performed during the Fall 2008 by ARCADIS on behalf of the County. This evaluation concluded that there was no current potential for exposure at residences downgradient of the landfill. However, vapor intrusion could potentially be a route of future exposure if a residential dwelling were to be constructed in the general area of soil boring SV-2.

The five-year review noted that since 1,4-dioxane had been found to be present at many sites where 1,1,1-trichloroethane was detected, this compound should be sampled for in the future. Based upon samples that were collected in June 2005 and December 2005, it was concluded that 1,4-dioxane is not present at the site. Groundwater samples were collected and analyzed for 1,4-dioxane from select monitoring wells during the June 2005 and September 2005 groundwater monitoring events. Since the concentration of 1,4-dioxane was below the limits of detection for all samples collected, it has been concluded that 1,4-dioxane is not a constituent of concern at the site.

Since the installation of groundwater wells is not restricted on the affected downgradient properties and since there are no restrictions on the landfill property to protect the integrity of the cap, monitoring wells, and extraction wells, the five-year review recommended that deed restrictions be placed on the affected properties and the landfill property to protect the integrity of the cap, monitoring wells, and extraction wells. Institutional controls are not in place. The County is currently seeking to place deed restrictions on all five of the affected properties to prevent the installation of groundwater wells. The County is also seeking to place restrictions on the landfill property to protect the integrity of the cap, monitoring wells, and extraction wells.

Since it is difficult to determine how the groundwater management system is performing hydraulically, the five-year review recommended that diagrams be prepared to show the steady-state potentiometric surface, well performance, and trend analyses (or alternative measures). Since the remedy was modified, a hydraulic capture analysis is no longer relevant.

Since New York State now requires annual certifications that institutional controls that are required by RODs are in place and that remedy-related O&M is being performed, the five-year review recommended that on an annual basis, the site be inspected to determine whether any intrusive activities have been performed and the building and property records be reviewed to ascertain whether or not any filings had been made for such activities. The annual O&M report that is currently submitted by the County should include a summary of the findings of these activities and that remedy-related O&M is being performed. These inspections are performed, the records are consulted, and the findings are included in the annual O&M report.. Once the required institutional controls are put into place, on an annual basis, the annual O&M report should include a certification that the institutional controls are in place, as well.

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components

The five-year review team consisted of George Jacob (RPM), Grant Anderson (hydrogeologist), Chloe Metz (human health risk assessor), and Michael Clemetson (ecological risk assessor, Biological Technical Assistance Group).

Community Involvement

The EPA Community Involvement Coordinator for the Colesville Landfill site, Michael Basile, published a notice in the *Binghampton Press & Sun Bulletin,* a local newspaper, on January 20, 2010, notifying the community of the initiation of the five-year review process. The notice indicated that EPA would be conducting a five-year review of the site to ensure that the site is protective of public health and the environment and that the implemented components of the remedy are functioning as designed. It was also indicated that once the five-year review is completed, the results will be made available in the local site repository. In addition, the notice included the RPM's address and telephone number for questions related to the five-year review process or the Colesville Landfill site.

Document Review

The documents, data, and information which were reviewed in completing the five-year review are summarized in Table 3 (attached).

Data Review

The average concentration of total volatile organic compounds (TVOCs) has decreased 60 percent during the five-year review period for monitoring wells located closest to the anaerobic bioremediation zone (i.e., monitoring wells GMMW-5, W-5, GMMW-6, and GMMW-2). The average concentration of PCE and its degradation compounds (i.e., PCE, TCE, 1,2-DCE, and VC) has decreased 80 percent during the five-year review period within the same wells. Of particular note is monitoring well GMMW-6, which has historically, by a significant margin, contained the highest concentration of contaminants at the site. Since reaching its maximum observed concentration of TVOCs in April 2003, the concentration of TVOCs at GMMW-6 has decreased 90 percent. The concentration of the more toxic contaminants (i.e., PCE, TCE, 1,2-DCE, and VC) have decreased 98 percent when making the same comparison. Finally, the

groundwater extraction wells have shown a general declining concentration trend since reaching their maximum TVOC concentration shortly after system startup in December 2002 and have decreased an average of 40 percent to 50 percent during this time. The data indicate the groundwater remedy is significantly reducing the mass flux of contaminants migrating from the landfill perimeter.

Five-Year Review Site Inspection

On November 10, 2009, a 5-year review-related site inspection was conducted by EPA Personnel, George Jacob, Michael Clemetson, Grant Anderson and Chloe Metz and NYSDEC Project Managers Payson Long and Will Welling. Also present at the site inspection were Dan Schofield and Laurie Haskell of Broome County and David Caballaro and Steven M. Feldman of ARCADIS.

Interviews

No interviews were conducted for this review.

Institutional Controls Verification

Since the site property is municipally-owned, NYSDEC has not required the County to obtain a property deed restriction. At this time, NYSDEC and EPA agree that institutional controls need to be implemented.

Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls

Table 4 (attached) summarizes several observations and offers suggestions to resolve the issues.

VI. TECHNICAL ASSESSMENT

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

The ROD, as modified by the ESDs, calls for, among other things, the installation of a cap, molasses injections, and contaminated groundwater collection and treatment. The purpose of the response action is to reduce the risk to human health and the environment due to contaminants leaching from the landfill mound. The capping of the landfill was to minimize the infiltration of rainfall and snowmelt into the landfill, thereby reducing the potential for contaminants leaching from the landfill and negatively impacting groundwater quality. Capping was to also prevent direct contact exposure to contaminated soils. The groundwater remediation system consists of a molasses reagent injection system to enhance naturally-occurring biologically mediated degradation of contaminants and a groundwater extraction component to capture contaminated groundwater near the site boundary and to provide injection reagent feed water. The objective of the groundwater remediation system is to ensure that groundwater beyond the site boundary meets Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater. This will be achieved by reducing the mass flux of contaminants migrating from the landfill perimeter to a concentration that naturally attenuates to ARARs for groundwater prior to leaving the site boundary.

As evidenced by groundwater quality data from the monitoring well indicative of groundwater quality below the cap (GMMW-7), VOCs continue to leach from the landfill and migrate from beneath the capped area even though the cap has been in place for 15 years. Monitoring wells located immediately downgradient from the line of injection wells are showing decreasing total VOCs and increasing daughter products (methane and ethene) as is evidenced by sample results from monitoring well GMMW-05, located just a few feet from an injection well; monitoring well GMMW-06, located approximately 100 feet downgradient; and monitoring well GMMW-02, located approximately 100 feet downgradient. These results indicate that the molasses injections are working. Well PW-4 shows no effect from the injections. Since the well is located 275 feet from the injection wells, it provides a rough idea of the treatment zone as it advects downgradient. That is, contaminant reduction is moving downgradient at a velocity of at least 13 feet/year, but less than 34 feet/year.

Groundwater monitoring data collected during the review period indicate that the remedy, as modified by the ESDs, is functioning as intended by the decision documents. Because of the low permeability of the aquifer, low extraction well yield rates, and the resulting impracticability of achieving hydraulic capture (i.e., drawdown propagates only a short distance from extraction wells), the intended objectives of the remedy are being met by controlling the chemical migration of VOCs in groundwater. The success of the groundwater remedy is being measured by the analysis of groundwater data which indicate decreasing contaminant concentrations in groundwater over time. By significantly reducing the mass flux of VOCs at the landfill perimeter with the anaerobic in-situ reactive zone, further reductions in VOC concentrations along the downgradient flowpath will result in achieving ARARs over time at downgradient areas. The average concentration of TVOCs has decreased 60 percent during the review period for monitoring wells located closest to the anaerobic bioremediation zone (i.e., monitoring wells GMMW-5, W-5, GMMW-6, and GMMW-2). The average concentration of the relatively more toxic contaminants (i.e., PCE, TCE, 1,2-DCE, and VC) has decreased 80 percent during the five-year review period within the same wells. Of particular note is monitoring well GMMW-6, which has historically, by a significant margin, contained the highest concentration of contaminants at the site. Since reaching its maximum observed concentration of TVOCs in April 2003, the concentration of TVOCs at GMMW-6 has decreased 90 percent. The concentration of the more toxic contaminants (i.e., PCE, TCE, 1,2-DCE, and VC) have decreased 98 percent when making the same comparison. Finally, the groundwater extraction wells have shown a general declining concentration trend since reaching their maximum TVOC concentration shortly after system startup in December 2002 and have decreased an average of 40 percent to 50 percent during this time. The data indicate the groundwater remedy is significantly reducing the mass flux of contaminants migrating from the landfill perimeter.

The subsurface stone collection trench and drainage layer in the area of the spring along the North Stream, which was installed to prevent the contaminated spring water from exfiltrating above the land surface, was damaged during a subsequent flood event. The collection trench and drainage layer were replaced with a riprap wall, which is no longer preventing the contaminated spring water from exfiltrating above the land surface. Therefore, this component of the remedy is not functioning as intended by the decision documents.

Sample data from the passive treatment system placed in the concrete structure continue to indicate that the VOCs are below NYSDEC Ambient Water Quality Values.

The ROD called for deed restrictions which prohibit the future drilling of wells on those properties that may be negatively affected by the VOC-contaminated groundwater plume. The ROD also called for deed restrictions to protect the integrity of the cap, monitoring wells, and extraction wells. While the site property is County-owned, there are no current plans to further develop it, and it is fenced, a restrictive covenant preventing activities that would disturb the cap and prohibit the installation of drinking water wells need to be drafted and filed.

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

There are no changes in the physical conditions of the Site or Site uses that would affect the protectiveness of the selected remedy. The landfill has been capped and the cap is being maintained, removing direct contact (i.e., ingestion or dermal contact with soil) exposures to the public as well as ecological receptors. A fence is in place to further prevent potential exposures to trespassers. Additionally, an extraction and treatment system and an automated reagent injection system are working to control and treat contaminated groundwater that may be moving off-Site. Potential exposure to contaminated groundwater has been eliminated and is not expected to occur in the next five years. The County has either purchased or installed new bedrock wells for all but one of the potentially impacted residences. One of the purchased properties is now vacant. The home will be demolished in 2010, and the residential well on the property will be decommissioned. The remaining privately-owned property, which is directly downgradient of the landfill, is currently abandoned and the house is dilapidated and uninhabitable.

The exposure assumptions and the toxicity values that were used to estimate the potential risks and hazards to human health followed the general risk assessment practice at the time the risk assessment was performed in 1988. Although the risk assessment process has been updated since 1988 and specific parameters and toxicity values may have changed, the risk assessment process that was used is still consistent with current practice and the need to implement a remedial action remains valid.

The most recent groundwater sampling shows that, at 22 ug/L, trichloroethylene still exceeds the state and federal standards, as well as the EPA health-based value, in monitoring well W-18, which is the most downgradient of the landfill (700 feet). Concentrations of this compound and others in wells closer to the site are higher. Since the drinking water pathway is currently incomplete, unacceptable risk is not posed by the exceedences of drinking water standards and the remedy remains protective. Continued monitoring of groundwater at the site is necessary, however. The remedial action objective of reaching state and federal groundwater standards has not been achieved, but it is anticipated that they will be reached in the future with continued treatment of the groundwater.

In the original risk assessment, surface water in the adjacent streams did not show contamination and, therefore, exposure to this medium was not evaluated. During the first five-year review inspection, a spring and a low-lying wet area were found to be contaminated with Site-related

compounds. The levels of vinyl chloride that were detected exceeded EPA's National Recommended Water Quality Criterion, which is designed to be protective of human health from consumption of freshwater fish and surface water as a drinking water source. Remedial measures to address these areas were undertaken in September 2003 and July 2004, respectively. A recent Site inspection revealed that the landfill appears to be impacting the stream once again, as evidenced by the presence of yellow boy in two places along the stream bank. Samples from SP-4 show low levels of 1,1-dichloroethane, which is a site-related contaminant, in the surface water downgradient of these areas. Water from the seepage areas should be sampled to ensure that there are no unacceptable human health and/or ecological impacts.

The ROD called for deed restrictions that would prohibit the future drilling of wells on those properties that may be negatively affected by the VOC-contaminated groundwater plume. Most of those properties are currently owned by the County. The ROD also called for deed restrictions to protect the integrity of the landfill cap, monitoring wells, and extraction wells. At the time of the last five-year review, these deed restrictions were not in place and the suggestion was made by EPA to finalize them. As of the Site inspection, the deed restrictions were still not in place; however, the County is still pursuing them.

Soil vapor intrusion was not evaluated in the 1988 risk assessment. The previous five-year review suggested that a vapor intrusion evaluation be performed. Because no homes were appropriate for subslab soil gas sampling (the only home directly downgradient of the landfill is dilapidated and the safety of the basement is questionable), ARCADIS collected six deep soil gas samples from the south side of East Windsor Road in October 2008. Five of the samples were east of the North Stream. The soil gas samples were collected from directly above the water table. The results show that if structures were built downgradient of the landfill today, vapor intrusion could be a concern primarily based on the concentration of trichloroethylene in SV-2 (550 ug/m^3).

Currently, the only houses that could be impacted are unoccupied (the house adjacent to the dilapidated house recently had a fire). If buildings were to be constructed in the future, or if these homes were to become reoccupied, an additional vapor intrusion evaluation would still be necessary to determine whether this would be a pathway of concern. If the potential for vapor intrusion still exists, one option would involve including a vapor mitigation system into the design of a building to be constructed and then sampling the indoor air once construction is complete to verify that the system is working as intended. The second option would be to complete construction and then sample the subslab and indoor air to determine whether a system is necessary.

The previous five-year review identified 1,4-dioxane as a potential contaminant at the Site due to the presence of 1,1,1-trichloroethane. Samples taken in 2005 from multiple wells show that this compound is not present at the site.

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

There is no information that calls into question the protectiveness of the selected remedy.

Technical Assessment Summary

Based upon the results of the five-year review, it has been concluded that:

- Although two small, low-lying areas of the cap where standing water was observed need to be filled and regraded, overall, there has been very little apparent settling of the cap. Evaluations of the landfill settlement and integrity of the liner have been conducted by the PRP subsequent to the field inspection, and corrective measures is expected to be completed by August 2010;

- The cap and vegetative cover are intact and in good condition;

- The fence around the cap within the site is intact and in good repair;

- The monitoring wells are functional;

- There is no evidence of trespassing or vandalism;

- The groundwater remedy is functioning as intended and is significantly reducing the mass flux of contaminants migrating from the landfill perimeter.

- The remedy has prevented residents from drinking contaminated groundwater; and

- No additional measures are needed to protect public health.

Monitoring wells located directly downgradient from the line of injection wells are showing decreasing total VOCs and increasing daughter products (methane and ethene) as is evidenced by sample results from monitoring well GMMW-05, located just a few feet from an injection well; monitoring well GMMW-06, located approximately 100 feet downgradient; and monitoring well GMMW-02, located approximately 100 feet downgradient. These results indicate that the molasses injections are working. Well PW-4 shows no effect from the injections. Since the well is located 275 feet from the injection wells, it provides a rough idea of the treatment zone as it advects downgradient. That is, contaminant reduction is moving downgradient at a velocity of at least 13 feet/year, but less than 34 feet/year.

It should be noted that the downgradient extent of the VOC plume has not been fully delineated at the site. While it is known that the plume extends to monitoring well W-18, which is located about 700 feet downgradient from the landfill, it is unknown if the plume reaches North Stream or the Susquehanna River.

The subsurface stone collection trench and drainage layer in the area of the spring along the North Stream, which was installed to prevent the contaminated spring water from exfiltrating above the land surface, was damaged during a flood event. The collection trench and drainage layer were replaced with a riprap wall, which is no longer preventing the contaminated spring

water from exfiltrating above the land surface. The leachate that is exfiltrating above the land surface is creating a yellow boy condition in the stream. It appears that the dilution power of the stream is sufficient to ameliorate the yellow boy before it extends more than 50 feet downstream, however. It is recommended that measures be taken to prevent the exfiltration of leachate at the North Seep, such as installing leachate extraction wells be installed on the landfill boundary above the North Seep, and that the extracted leachate go to the groundwater treatment system.

During the five-year review site visit, it was observed that considerable "yellow boy" staining was coming out of the mitigation system and flowing beyond the property line to a small stream next to the roadway. Although the effluent is currently being sampled for VOCs, EPA believes that metals should also be included in the parameter list as they are a major component of landfill leachate.

VI. ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

Table 5 (attached) contains recommendations and follow-up actions which should ensure long-term protectiveness.

VIII. PROTECTIVENESS STATEMENT

The implemented actions at the site protect human health and the environment in the short-term; however, in order for the site to be protective in the long-term, institutional controls need to be implemented. Currently, there are no exposure pathways that could result in unacceptable risks and none are expected, as long as the site use does not change and the engineered and access controls that are currently in place continue to be properly operated, monitored, and maintained.

IX. NEXT REVIEW

Since hazardous substances, pollutants or contaminants remain at the Colesville Landfill site which do not allow for unlimited use or unrestricted exposure, in accordance with 40 CFR 300.430 (f) (4) (ii), the remedial action for the site shall be reviewed no less often than every five years. EPA will conduct another five-year review on or before February 2015.

Approved:

_____ _____

Walter E. Mugdan, Director Date
Emergency and Remedial Response Division

Table 1: Chronology of Site Events	
Event	**Date(s)**
Operation of landfill	1969-1984
Samples collected by Broome County Health Department from residential wells in vicinity of site indicate that landfill contaminating groundwater	1983
Site placed on National Priorities List	1986
Record of Decision	1991
Cap Remedial Design	1991-1994
Cap Remedial Action	1995
Alternate Water Supply Well Remedial Design	1995
Explanation of Significant Differences	2000
Groundwater Remedial Design	2000-2004
First Five-Year Review Conducted	2000
Alternate Water Supply Well Remedial Action	2002
Groundwater Remedial Action	2002-2004
Explanation of Significant Differences	2004
Preliminary Site Close-Out Report	2004
Second Five-Year Review Conducted	2005

Table 2: Annual Operation, Maintenance, and Monitoring Costs	
Activity	**Cost per Year**
Groundwater Remediation OM&M, Injection of Molasses	$60,000
Groundwater Monitoring, Sampling and Analysis	$65,000
Data Management and Reporting	$30,000
Site Inspection/Maintenance	$25,000
Total estimated cost	*$180,000*

Table 3: Documents, Data, and Information Reviewed in Completing the Five-Year Review	
Document Title, Author	**Submittal Date**
Remedial Investigation/Feasibility Study, Wehran Engineering	1990
Record of Decision, EPA	1991
Operation and Maintenance Monitoring Manual, ARCADIS	1994
Groundwater Remediation System Engineering Report, ARCADIS	2000
Five-Year Review Report, EPA	2000
Explanation of Significant Differences, EPA	2000
Spring Remedy, ARCADIS G & M Inc.	2003
Explanation of Significant Differences, EPA	2004
Preliminary Close-Out Report, EPA	2004
Interim Remedial Action Report, ARCADIS	2004
2005 Annual Monitoring Report, ARCADIS	2005
Second Five-Year Review Report, EPA	2005
2006 Monitoring Report, Quarter 4, ARCADIS	2006
2007 Annual Monitoring Report, ARCADIS	2007
2008 Annual Monitoring Report, ARCADIS	2008
2009 Annual Monitoring Report, ARCADIS	2009
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new Applicable or Relevant and Appropriate Requirements relating to the protectiveness of the remedy have been developed since EPA issued the ROD.	

Table 4: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls	
Comment	**Suggestion**
The previous five-year review noted that a seep was observed on the south side of the landfill, which could potentially overflow to the South Stream. Since a seep at this location had not been observed previously, the five-year review suggested that it was possible that the seep was attributable to heavy rains prior to the site inspection. The five-year review recommended that if the seep still existed, it should be sampled, and if the sampling shows that it is contaminated, it needed to be remediated. While the seep was not observed during semi-annual inspections conducted since the last five-year review, it reappeared in the 2010 five-year review inspection.	Further inspection and sampling are warranted as recommended before.
During the five-year review site visit, it was observed that considerable "yellow boy" staining was coming out of the mitigation system at the South Seep and was flowing beyond the property line to a small stream next to the roadway. Although the effluent is currently being sampled for volatile organic compounds, metals should also be included in the parameter list as they are a major component of landfill leachate.	The stream water should be sampled for full Target Analyte List/Target Compound List (TAL/TCL) parameters.
The carbon container from the passive treatment system placed in the concrete structure is loose.	The lid to the carbon container should be secured.
During the previous five-year review site visit, it was noted that there were several points of differential compaction which had created wetlands on the cap on the landfill. It was recommended that these areas of differential compaction be repaired before the impermeable membranes were ruptured. Based on	It is again recommended that the differential compaction areas be repaired.

Table 4: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls	
Comment	**Suggestion**
these recommendations, Broome County initiated studies to evaluate the depressed area of the landfill. In August 2005, a field investigation was conducted by C&S Engineers in which the geomembrane liner was exposed in six locations of the depressed area, and one location outside of the depressed area for baseline analysis. The study concluded that there were no apparent signs of stress or tension in the geomembrane liner and no signs of undue wear or damage were observed. However, corrective measures were not implemented to provide positive surface water drainage. Based on assurances from Broom County, the corrective measures will be completed by August 2010.	
New York State now requires annual certifications that institutional controls that are required by RODs are in place and that remedy-related O&M is being performed. On an annual basis, the site is inspected to determine whether any intrusive activities have been performed. The annual O&M report that is currently submitted by the Performing Party includes a summary of the findings of the inspection along with a certification that remedy-related O&M is being performed.	Once the required institutional controls are put into place, on an annual basis, the annual O&M report should include a certification that the institutional controls are in place.

Table 5: Recommendations and Follow-Up Actions						
Issue	**Recommendations and Follow-Up Actions**	**Party Responsible**	**Oversight Agency**	**Milestone Date**	**Affects Protectiveness (Y/N)**	
					Current	**Future**

Table 5: Recommendations and Follow-Up Actions

Issue	Recommendations and Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Institutional controls prohibiting the installation of groundwater wells and to protect the integrity of the cap and extraction wells are not in place. In addition, the installation of groundwater wells is not restricted on the five affected properties.	Restrictions need to be placed on the landfill property to protect the integrity of the cap, monitoring wells, and extraction wells. Deed restrictions need to be placed on all five of the affected properties to prevent the installation of groundwater wells.	PRP	NYSDEC	02/11	N	Y
The subsurface stone collection trench and drainage layer in the area of the spring along the North Stream, which was installed to prevent the contaminated spring water from exfiltrating above the land surface, was damaged during a flood event. The collection trench and drainage layer were replaced with a riprap wall, which is no longer preventing the contaminated spring water from exfiltrating above the land surface. The leachate is not being tested, so there is no knowledge of current contaminant loading. The leachate is also creating a "yellow boy" condition in the stream.	Sample the spring water for full TAL/TCL parameters. Measures need to be taken to prevent the exfiltration of leachate at the North Seep, such as installing leachate extraction wells on the landfill boundary above the North Seep. Leachate at this location could be effectively captured via boundary wells on the landfill and pumped to the groundwater treatment system without any disruption to the current riprap and slope stabilization system.	PRP	NYSDEC	02/11	N	Y