FIFTH FIVE-YEAR REVIEW REPORT FOR SINCLAIR REFINERY SUPERFUND SITE ALLEGANY COUNTY, NEW YORK

Prepared by

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

John Prince, Acting Director
Emergency and Remedial Response Division

June 12, 2017
Date

510620

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS 2
I. INTRODUCTION 3
FIVE-YEAR REVIEW SUMMARY FORM 4
II. RESPONSE ACTION SUMMARY 5
Basis for Taking Action 5
Response Actions 6
Remedy Selection 6
Remedy Implementation 8
Genesee River - Partial Channelization 8
South Landfill Area Excavation and Consolidation 9
Landfill Capping 9
Surface Soils Excavation and Disposal 10
Groundwater Remediation - Phase 1 10
Groundwater Remediation - Phase 2 11
Status of Implementation 13
IC Summary Table 13
Systems Operations/Operation & Maintenance 14
III. PROGRESS SINCE THE LAST REVIEW 16
IV. FIVE-YEAR REVIEW PROCESS 17
Community Notification, Involvement & Site Interviews 17
Data Review 17
Site Inspection 18
V. TECHNICAL ASSESSMENT 19
QUESTION A: Is the remedy functioning as intended by the decision documents? 19
QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid? 20
QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy? 22
VI. ISSUES/RECOMMENDATIONS 23
VII. PROTECTIVNESS STATEMENT 23
VIII.NEXT REVIEW 23
APPENDIX A – REFERENCE LIST 24
APPENDIX B – GROUNDWATER TABLES 25
APPENDIX C - SITE MAP 28

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ICs	Institutional Controls
LNAPL	Light non-aqueous phase liquid
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
PPM	Parts per million
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
SVI	Soil Vapor Intrusion
UAO	Unilateral Administrative Order

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Sinclair Refinery Superfund Site (site). The triggering action for this statutory review is the signing date of the previous FYR Report, September 5, 2012. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The site consists of two operable units (OUs) which will be addressed in this FYR. OU1 addresses the landfill remediation and river rechannelization. OU2 addresses surface soils, sediment, and groundwater at the former refinery.

The Sinclair Refinery Superfund Site FYR was led by Michael Negrelli, EPA Remedial Project Manager (RPM). Participants included Edward Modica, EPA hydrologist, Nicholas Mazziotta, EPA human health risk assessor, Michael Clemetson, EPA ecological risk assessor, Michael Basile, EPA community involvement coordinator, Brian Carr, EPA site attorney, and Maurice Moore, New York State Department of Environmental Conservation (NYSDEC) project manager. The potentially responsible party (PRP) for the site, the Atlantic Richfield Company (ARCO), a British Petroleum (BP) affliliated company, was notified of the initiation of the FYR. The review began on 11/15/2016.

Site Background

The Sinclair Refinery site is situated between the Genesee River and South Brooklyn Avenue, one-half mile south of downtown Wellsville, in Allegany County, New York. The northerly flowing Genesee River forms the eastern and southern boundaries of the site, South Brooklyn Avenue forms the western boundary, and a former refinery access road forms the northern boundary. The site consists of two areas: a 90-acre refinery area and a 10-acre landfill area. A 14-acre tank farm, located approximately one-quarter mile west of the site, was investigated as part of the remedial investigation and found to have no contaminants of concern and is no longer considered part of the site. All of the response actions are limited to the 100 acres of the refinery and landfill. A general site map is included as Appendix C.

The refinery area is characterized by generally flat land sloping gently towards the Genesee River. Site geology is dominated by fluvial and glacial sediments, which are highly variable unconsolidated deposits composed of sands, clays, and gravel. Fill material is also present in site soils, similarly composed of sands, clays, and gravel. Within the unconsolidated deposits beneath the site are at least three hydrogeologic units: an upper aquifer comprised of recent fluvial deposits, an aquitard comprised of glaciolacustrine clay, and a poorly defined lower aquifer comprised of glacial sands. Depths to the glaciolacustrine clay layer at the refinery range on average between 15 and 30 feet from the surface and

average depth to the water table ranges between 5 and 10 feet from the surface. Groundwater flow at the site is generally to the north and east, discharging directly into the Genesee River. The Genesee River is a local source of drinking water, and the intake for the Village of Wellsville municipal water supply is located approximately one-quarter mile upstream of the site. Water on the site is supplied by the Village municipal system.

The area where the site is located also contains a man-made wetland area referred to as the main drainage swale. This wetland habitat was created as a result of the construction of a dike to prevent the Genesee River from eroding portions of the site. The Genesee River is also an important ecological resource for the State of New York, as well as being the primary drinking water source for the Village of Wellsville.

The refinery was built in 1901 for the processing of Pennsylvania grade crude oil. The Sinclair Refining Company purchased the refinery in 1919 and operated it through 1958, when a fire halted operations. In 1969, the Sinclair Refining Company merged with ARCO. During the operating history of the refinery, the company manufactured products such as heavy oils and grease for lubrication applications, light oil for fuel, naphtha, gasolines, aniline, lighter fluid and paraffin. While the wastes associated with the manufacture of such products were primarily disposed of in the landfill located at the site, waste handling operations at the time also led to the contamination of the refinery surface soils, subsurface soils and groundwater.

When refinery operations ceased in 1958 as the result of a fire, the Sinclair Refining Company transferred the majority of the site property to the Village of Wellsville, which, in turn, conveyed some of the parcels to various companies and other entities. Currently, most of the site is occupied by the State University of New York at Alfred's Wellsville Campus. Other site occupants include a small manufacturing/technology company, a truck depot, a power transmission right-of-way, and a public recreational trail. About 30 structures exist on-site, made of either brick or corrugated aluminum and steel frame construction. Approximately 500 people use the buildings located on the site on a daily basis. Site usage is considered active and the site is expected to continue to be actively used.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Sinclair Refinery		
EPA ID: NYD980535215		
Region: 2	**State:** NY	**City/County:** Wellsville/Allegany
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		

Author name (Federal or State Project Manager): Michael Negrelli
Author affiliation: EPA
Review period: 10/1/2012 - 6/30/2017
Date of site inspection: 6/6/2017
Type of review: Statutory
Review number: 5
Triggering action date: 9/5/2012
Due date *(five years after triggering action date)*: 9/5/2017

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

For purposes of investigation and remediation, the site is being addressed in two distinct OUs. OU1, which consists of the 10-acre landfill portion of the site, (formerly consisting of the Central Elevated Landfill Area (CELA), the South Landfill Area (SLA), and the area between the two landfills) and OU2, which consists of the 90-acre former refinery.

The OU1 remedial investigation/feasibility study (RI/FS) identified the following wastes deposited in the landfill: cloth filters used for straining oil; sludges from an oil/water separator; tank sludges from the solvent plant; off-specification products; oil-soaked soils and sludges (deposited daily); burnt Fullers Earth (used for filtering); tank sludges (deposited weekly); acid spills; cinders and ash from the coal-fired boiler plant; tetraethyl lead; pesticides; waste oil; and heavy metals.

A public health threat analysis (i.e., risk assessment) was performed as part of the RI/FS. The results indicated that although the landfill wastes did not generate a substantial amount of leachate and did not appear to be migrating readily from the landfill area, the landfill area as a whole must be considered a serious potential source of contamination by virtue of the hazardous substances deposited there. The most significant threat from the landfill was determined to be from flooding or failure of the landfill slopes; failure of the landfill into the Genesee River would have a serious negative impact on public health and the environment. Additionally, the potential for localized organic compound vaporization was found to be a potential contaminant migration mechanism, and thereby a potential threat to the local population.

It was further determined that remedial alternatives addressing the refinery portion of the site needed to be evaluated as part of a supplemental (OU2) RI/FS. ARCO agreed to perform the OU2 RI/FS as memorialized in an Administrative Consent Order issued by the EPA on July 28, 1988. The results of the OU2 RI/FS identified VOCs and SVOCs and metals as contaminants of concern in the refinery area. Sampling and analysis of the surface soils indicated the presence of arsenic and lead above action levels selected for the site. Sampling and analysis of subsurface soils indicated the presence of VOCs and SVOCs as well as arsenic and lead, but at levels lower than those found in the surface soils. Sampling and analysis of the groundwater in the refinery area indicated three plumes (the northern, central, and southern plumes) in the shallow aquifer with levels of benzene, toluene, ethylbenzene, xylene, nitrobenzene, naphthalene, arsenic, chromium and lead above action levels selected for the site.

A risk assessment was performed as part of the OU2 RI/FS and several potential exposure pathways were evaluated. The risk assessment assumed current and future land use as industrial. The greatest risk factor was attributed to the inhalation of fugitive dust, primarily due to arsenic found in site surface soils. Consequently, a risk-based arsenic cleanup number was generated (25 parts per million (ppm)). Additionally, EPA guidance for establishing lead cleanup levels in soil at Superfund sites indicated that 1,000 ppm would be a protective cleanup level based on current and anticipated future land use, which is industrial. The clean up level was based on the Interim Guidance on Establishing Soil Lead Cleanup Levles at Superfund sites (OSWER Directive #9355-4-02) issued on September 7, 1989. EPA concluded the clean up level of 1,000 ppm to be appropriate for the site based on site-specific conditions. Finally, although the shallow aquifer at the site is not a current drinking water source, the aquifer is designated by New York State as a potential source of potable water, thereby making it subject to cleanup levels established by federal and State laws and regulations (i.e., maximum contaminant levels (MCLs) and ambient water quality standards).

Subsequently, a focused human health and ecological risk assessment was conducted for soils and sediments on-site. An ecological risk analysis was performed to determine potential impacts to native species of the swale environment. Accordingly, the main drainage swale exhibited some limited areas of arsenic contamination that would likely cause adverse impacts to native biota. Also, a human health risk analysis was performed following the river investigation using the analytical samples taken of the soil media from the river bank. The results of this analysis established a potential future noncancer health risk to construction workers on the river bank due to arsenic exposure.

Response Actions

Remedy Selection

As a result of the OU1 RI/FS, EPA selected a cleanup plan for the landfill portion of the site which was embodied in a September 26, 1985 Record of Decision (ROD) for OU1. The ROD outlined the remedial action objectives (RAOs) to address the risks to public health and the environment identified in the RI/FS. The RAOs for OU1 include:

- Maintenance of a safe, uncontaminated drinking water supply for the Village of Wellsville;
- Protection of Genesee River water quality and associated uses (potable water supply, fishing, recreation) from contaminant releases;
- Protection of local groundwater, which discharges to the Genesee River, from contaminant migration;
- Prevention of direct contact between humans and animals with contaminated site materials, including soil and leachate;
- Avoidance of site inundation from increased river flow associated with a 100-year storm event; and
- Avoidance of site erosion from a 100-year storm event.

To meet the RAOs for OU1, the remedial actions identified in the 1985 ROD included:

- the partial channelization of the Genesee River to protect the landfill from erosion and flooding;
- the removal and disposal of drums from the surface of the CELA;
- the excavation of the SLA and its consolidation onto the CELA, and backfilling of the excavated area with clean fill;
- the construction of a cap over the consolidated landfill; and
- the construction of a fence around the consolidated landfill.

ARCO agreed to implement the remedial actions, with modifications to the original plan for partial channelization of the Genesee River. This agreement was memorialized in a judicial Consent Decree which was signed by the United States and ARCO and entered with the U.S. District Court for the Western District of New York on May 19, 1989.

Subsequently, the required work was organized into three separate remedial actions, namely: the partial channelization of the Genesee River (completed in 1992); the drum removal, excavation, consolidation, and backfilling of the SLA (completed in 1992); and the capping and fencing of the consolidated landfill (completed in 1994).

As a result of the OU2 RI/FS, EPA selected a remedy for the second operable unit in a ROD (OU2 ROD) signed on September 30, 1991. The ROD outlined the RAOs to address the risks to public health and the environment identified in the RI/FS. The RAOs for OU2 include:

- A cleanup level for arsenic in site surface soils of 25 ppm, determined to be protective of human health and the environment based on the site risk assessment;
- A cleanup level for lead in site surface soils of 1000 ppm, determined to be protective of human health and the environment based on EPA guidance and current site land use; and
- A cleanup level for groundwater as established by state and federal regulations for a groundwater aquifer designated as a potential drinking water source.

The remedial actions selected in the ROD included:

- The excavation of surface soils exceeding the remedial cleanup criteria for arsenic (25 ppm) and lead (1000 ppm) to a depth of one foot, followed by confirmatory sampling and backfilling with clean fill. Excavated soils would then be treated as necessary to comply with applicable regulations prior to consolidation into the on-site landfill prior to closure;
- Long-term monitoring of surface water, groundwater, and soil-gas to track potential contaminant migration from the subsurface soils;

- Treatment of contaminated groundwater with the goal of achieving applicable or relevant and appropriate requirements (ARARs). Contaminated groundwater would be extracted, treated, and discharged either directly to the Genesee River or via the Publically Owned Treatment Works; and

- Institutional controls in the form of local zoning ordinances would be recommended to account for any construction activity that would alter present site use or otherwise open an exposure pathway to subsurface soils. If such construction activity were to occur, an evaluation of the impacts of the proposed construction in regard to site contamination and exposure pathways would be reviewed and evaluated by EPA and New York State.

Unilateral Administrative Orders (UAOs) for remedial design and remedial action were issued by EPA to ARCO on May 1, 1992 and September 8, 1992 for the OU2 work, which was organized into two separate remedial actions. These consisted of the surface soils excavation and disposal as the first remedial action, completed in 1994, and the monitoring and groundwater remediation components as the second remedial action, which was completed in 2012.

In August 2009, EPA issued an Explanation of Significant Differences (ESD) which documented modifications to the OU2 pumping and treatment groundwater remedy, referred in subsequent sections as "Phase 2-1." The modified Phase 2-1 remedy included the installation and operation of a groundwater collection trench to intercept the impacted groundwater from the aquifer and prevent the migration of contaminants into the Genesee River. The groundwater in the intercept trench would be conveyed by pumps to a constructed wetland at the southern end of the site where the contamination is treated by natural processes. The system would be subject to long-term monitoring and maintenance.

The ESD also identified further soil and sediment removal and backfill actions to address light non-aqueous phase liquid (LNAPL) contamination in surface water bodies associated with the site. Sediments would be excavated in two identified areas: the deep sediment area and shallow sediment area. In addition, soils on the Genesee River bank where LNAPL was visually observed would be subject to excavation and backfilling. Finally, impacted soils and sediment on the western embankment of the main drainage swale would also be excavated and backfilled. These construction activities, and the placement of excavated soil and sediment into the CELA and its restoration, are referred in subsequent sections as "Phase 2-2."

The ESD also modified the institutional controls in the OU2 ROD. The goals set forth in the OU2 ROD would be implemented through proprietary institutional controls in the form of environmental easements/restrictive covenants to be placed on all properties at the site.

Remedy Implementation

Genesee River - Partial Channelization

The remedial action for partial channelization of the Genesee River was carried out in accordance with the requirements of the 1989 Consent Decree. The components of this phase of the remediation included the following:

- Protection of the consolidated landfill from bank erosion and flood inundation during floods up to a 100-year event on the Genesee River;

- Protection of the east bank, from an existing sheet pile weir to approximately 2000 feet from the existing riprap upstream of the weir; and

- Improvement of river flow conditions approaching the weir located downstream from the landfill.

The design to accomplish this work was approved by EPA on February 21, 1990 and construction commenced on July 24, 1990. The work was carried out by ARCO's contractor and overseen by the U.S. Army Corps of Engineers through an interagency agreement with EPA. EPA performed a final inspection of the construction on October 3, 1991; the remedial action was completed upon EPA's approval of the Remedial Action Report on March 27, 1992.

South Landfill Area Excavation and Consolidation

The remedial action for the SLA was implemented in accordance with the 1989 Consent Decree, and consisted of the following:

- Excavation and consolidation of the wastes from the 2.3-acre SLA onto the 9.2-acre CELA;

- Filling the excavated area with clean fill from an off-site source; and

- Placement of a temporary cover over the portion of the CELA which received waste from the SLA, pending the final remediation of the CELA.

The design to accomplish this work was approved by EPA on September 26, 1990 and construction commenced on October 15, 1990. The excavation was completed in November 1990, but backfilling of the excavated area was suspended due to the onset of the winter season and completed the following year. The work was carried out by ARCO's contractor and overseen by the U.S. Army Corps of Engineers through an interagency agreement. EPA performed a final inspection of the construction on October 3, 1991; the remedial action was completed upon EPA's approval of the Remedial Action Report on March 27, 1992.

Landfill Capping

The remedial action for the capping of the consolidated landfill was also carried out in accordance with the requirements of the 1989 Consent Decree. The objectives of this phase of the remediation included the following:

- Removal of drums from the landfill, with empty drums shredded and placed over the surface of the waste and drums with contents being disposed of off-site;

- Construction of a soil-bentonite cutoff wall around the landfill perimeter;

- Stabilization of soft sludge wastes within the landfill;

- Regrading of the landfill;

- Construction of a geosynthetic and soil cap over the landfill surface to be tied in to the soil-bentonite cutoff wall;

- Construction of a passive gas vent system within the cap;

- Installation of monitoring wells around the landfill, piezometers within the landfill, and pipe sleeves within the landfill cap for possible future access; and

- Installation of a permanent security fence around the capped landfill.

The design to accomplish this work was approved by EPA on December 6, 1991 and construction commenced in June 1992. The work was carried out by ARCO's contractor and overseen by the U.S. Army Corps of Engineers through an interagency agreement. EPA performed a final inspection of the construction on July 8, 1993; the remedial action was completed upon EPA's approval of the Remedial Action Report on January 28, 1994.

Surface Soils Excavation and Disposal

The remedial action for the refinery surface soils excavation was implemented in accordance with the May 1992 UAO. The objectives of the remedial action consisted of the following:

- Excavation of refinery surface soils exhibiting concentrations above 1000 ppm of lead and 25 ppm of arsenic to a depth of one foot below surface;

- Consolidation of the excavated soils into the landfill prior to closure;

- Filling the excavated area with 6 inches of clean soil and 6 inches of topsoil; and

- Revegetation of the disturbed areas.

The design to accomplish this work was approved by EPA on May 29, 1992 and construction commenced on July 8, 1992. The work was completed in early 1994, necessitating some of the excavated soil to be disposed of at an approved off-site facility. The work was carried out by ARCO's contractor and overseen by the U.S. Army Corps of Engineers through an interagency agreement. EPA performed a final inspection of the construction on May 10, 1994; the remedial action was completed upon EPA's approval of the Remedial Action Report on November 23, 1994.

Groundwater Remediation - Phase 1

The OU2 ROD called for the pumping and treatment of contaminated groundwater at the site with the goal of achieving drinking water standards. EPA issued the September 1992 UAO to ARCO for the remedial design and remedial action of this remedy. In late 1993, ARCO approached EPA with a proposal to implement an air sparging/soil vapor extraction (AS/SVE) remedy, which would essentially remediate the subsurface sources of groundwater contamination at the site, with a smaller component of pumping and treatment, claiming these systems would be as effective in meeting the OU2 ROD performance standards and less costly. EPA agreed to allow ARCO to pursue this proposal as a site-wide pilot program (Phase 1) under the condition that if monitoring data collected during the implementation of the AS/SVE system could not demonstrate the effectiveness of the system in achieving the cleanup goals of the ROD,

then another program to meet those cleanup goals would have to be implemented by ARCO (Phase 2). In 1995, ARCO began Phase 1 at the site which essentially applied AS/SVE to the southern and central plumes at the site and a limited pumping and treatment component (three recovery wells) at the downgradient edge of the northern plume. After a failed attempt to apply AS/SVE at the upgradient portion of the northern plume, an AS/SVE system was later added further downgradient in a more geologically suitable location.

ARCO provided EPA with monitoring data from the time that the systems began operating. After the Phase 1 system operated for a number of years, the results of the monitoring data indicated that AS/SVE was not an effective technology in meeting drinking water standards in the groundwater plumes at the site. Although the systems implemented by ARCO effectively removed large quantities (approximately 160,000 pounds) of subsurface contamination from the subsurface soils that become seasonally saturated with a rising and falling water table, the systems had little effect on the groundwater plumes. Conversely, the limited pumping and treatment that was carried out at the site under Phase 1 appeared to be an effective means of reducing contaminant levels in the groundwater aquifer, and monitoring results showed the area of the plumes nearest to the recovery wells to be at or near MCLs. In September 2002, EPA notified ARCO by letter that the Phase 1 program had not met the performance standards of the OU2 ROD and that a Phase 2 program, based on the original pumping and treatment remedy from the OU2 ROD, needed to be implemented.

Groundwater Remediation - Phase 2

Following EPA's notification in 2002 that a Phase 2 groundwater remedy needed to be implemented, ARCO initiated remedial design activities. Following the submission of the Phase 2 Pre-Final Design Report for OU-2 in November 2005, a decision was made to separate the Phase 2 remediation into two separate portions, Phase 2-1 and Phase 2-2, so that some elements of the remedial design could be expedited while other elements were further evaluated by the regulatory agencies. The following sections describe the aspects of the Phase 2-1 and Phase 2-2 remedial work. The use of innovative technologies became an integral part of the Phase 2 groundwater remediation, and EPA published an ESD in August 2009 to document how these technologies varied from the original pumping and treatment remedy outlined in the OU2 ROD.

OU-2 Phase 2-1: Groundwater Collection and Treatment

Phase 2-1 is the remedial action for the refinery groundwater and was implemented in accordance with September 1992 UAO. The objectives of the remedial action for Phase 2-1 consisted of the following:

- Installation of a Groundwater Collection System consisting of a 3,300 foot long collection trench;
- Installation of eight manholes in the collection trench to house pumping systems to transfer groundwater to the wetland treatment system;
- Installation of a conveyance system to transfer groundwater to the wetland treatment system; and
- Installation of the components of the wetland treatment system.

The design to accomplish this work was approved by EPA in March 2007. Construction began in July 2007 and was completed in September 2008.

The Phase 2-1 remedy consists of a 3,300 foot long collection trench running the entire length of the site, tied into clay and designed to intercept the contaminated groundwater of the shallow aquifer. An in-trench pumping system conveys the contaminated groundwater to a constructed wetland treatment system at the southern end of the site. Components of the wetland treatment system include a sedimentation pond and sludge drying beds to collect solids and metals, and a sequence of surface flow wetlands, vertical flow wetlands, and a cascade aerator to remove VOCs and SVOCs. Discharge occurs at a single monitored outfall at the head of the main drainage swale with compliance monitoring conducted to meet the terms of a New York State regulated permit. EPA's evaluation of the design of the system indicated that it was an effective and innovative approach to groundwater remediation. In its August 2009 ESD, EPA notified the public that the approach was essentially the same as the pumping and treatment remedy outlined in the OU2 ROD but at less cost. The collection trench with subsurface pumps served the same function as the series of pumping wells described in the ROD and the elements of the wetland treatment system provided the same functions as a central collection tank, solid removals step, air stripping, and carbon adsorption which would be incorporated into a water treatment plant. Additionally, this use of innovative technologies is a decidedly greener remedy (for example, by using natural components such as wetlands and a sedimentation pond rather than the mechanical components of a water treatment plant, the remedy is both less wasteful and requires less energy to operate).

The system became operational in December 2008 and after minor modifications were made during the first six months, the system has been operating continuously since June 2009. EPA performed a final inspection of construction of the Phase 2-1 remedy on July 14, 2011. A Remedial Action Report prepared by ARCO was approved by EPA in September 2012.

OU-2 Phase 2-2: Sediment and Soil Excavation

Phase 2-2 is the remedial action to mitigate residual LNAPL contamination in subsurface riverbank soils and riverbed and main drainage swale sediment which would seasonally seep onto the surface of the Genesee River and surface water in the main drainage swale. Following the initial appearance of these sheens, ARCO implemented an interim remedy that involved the placement of collection booms and adsorbent pads. The Phase 2-2 remedial action mitigates the seeps through a permanent remedy. The objectives of the remedial action for Phase 2-2 consisted of the following:

- Removal and restoration of impacted sediments from the main drainage swale;
- Installation of a mid-slope sheet pile wall along the Genesee River for structural support;
- Removal of impacted bank soils and sediment from the Genesee River followed by restoration;
- On-site disposal of excavated soils/sediments in a new cell on the CELA;
- Installation of a water level control berm in the main drainage swale to aid groundwater capture and mitigate groundwater seeps; and
- Final site restoration consisting of a public recreational trail along the top of the riverbank and CELA restoration using wildflowers and native grass species.

The design to accomplish this work was approved by EPA in April 2009. In its August 2009 ESD, EPA notified the public that the Phase 2-2 work in the Genesee River and main drainage swale was an expansion of the excavation and removal parameters for impacted soil established in the OU2 ROD. The OU2 ROD also provided for impacted soils to be disposed of in the CELA.

The work for Phase 2-2 began in September 2008. The Genesee River and main drainage swale excavation work was completed in 2010 and restoration of the recreational trail was completed in early 2011. A

ribbon-cutting ceremony reopening the trail to public use, along with a final construction inspection conducted by EPA, was conducted on July 14, 2011. Final restoration of the CELA was completed in June 2012. A Remedial Action Report prepared by ARCO was approved by EPA in September 2012.

Status of Implementation

The previous section of this report summarizes the implementation of the remedial actions carried out at the site. EPA continues to monitor the systems in place at the site to ensure their effectiveness in meeting site cleanup goals. Following is a discussion of institutional control implementation.

Institutional Control Implementation

In its 2009 ESD, EPA modified the institutional control (IC) goals set forth in the OU2 ROD such that they are to be implemented through proprietary ICs in the form of environmental easements/restrictive covenants ("easements") to be placed on all properties at the site. A total of nine properties are impacted. [The 2012 FYR identified ten properties which required easements; one of these ten property owners relocated to a property off-site and the former space was taken over by a current property owner, thereby reducing the number of required easements to nine].

In 2011, ARCO conveyed the property containing the CELA and wetland treatment system to SUNY Alfred with restrictions on groundwater use, as well as restrictions to ensure that the integrity of the remedial systems in place is maintained and that any future use of the property is done in accordance with a site management plan, which, among other things, addresses residual subsurface soil contamination and potential vapor mitigation issues for any structures which may be constructed on the property. The deed restrictions also prevent the property from being used for residential purposes, including single or multi-family dwellings or rental units, child or elder care facilities, nursing homes or hospices, hotels or motels, medical or dental facilities, a church, an elementary or high school, entertainment or recreational facility, or a hospital. In addition, ARCO became the grantee to an easement on property already owned by SUNY Alfred which provided for the same restrictions discussed above. For the remaining seven separately owned parcels, ARCO contacted the land owners and generally discussed the same types of engineering and institutional controls as the completed easement/covenant. The easements/covenants for these remaining properties were signed and recorded during the period October 2013 through October 2014. No further action is required with respect to institutional control implementation.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater and Sub-surface Soils	Yes	Yes	All site properties (9 total parcels)	Restrict installation of ground water wells and ground-water use; employ site management plan for soil vapor intrusion; preserve remedy components	Environmental Protective Easement and Declaration of Restrictive Covenants, July 2011-October 2014

Systems Operations/Operation & Maintenance

Landfill

Routine operation and maintenance (O&M) of the OU1 remedy has been ongoing since the completion of the remedial action in 1994. Annual reports are provided to EPA for review. O&M activities include quarterly inspections of the landfill cap and associated systems and annual subsidence surveys and groundwater monitoring events. Typical maintenance activities have included mowing the vegetation on the cap surface and removing overgrowth around well heads and the riprap on the riverbank. Eroded topsoil on the cap is replaced and reseeded as needed. Review of the annual reports and inspections during site visits indicate that all systems are operating efficiently. There is also an access control in place for OU1 in the form of a security fence which is being maintained to prevent unauthorized access to the landfill. In addition, there is a restrictive covenant tied to the deed for the 10-acre parcel containing the landfill. The covenant provides for: no excavation, operation or parking of vehicles, or any activity that would otherwise disturb the facilities on the premises; access to the site for maintenance by ARCO; and the owner will notify ARCO if any party or event disturbs the facilities.

In November 2011, ARCO submitted a revised O&M Plan for the site. The revised O&M Plan combines inspection and maintenance activities in a single document for both OU1 and OU2 and considers activities to be performed in four areas of the site including:

- CELA O&M Requirements
- Groundwater Collection Trench O&M Requirements
- Wetland Treatment System O&M Requirements
- River Channel and Swale O&M Requirements

As part of the CELA reuse and restoration program (Phase 2-2), certain O&M activities have been modified and are described in the revised O&M Plan. For example, CELA restoration work included using wildflowers and native grass species, eliminating the need for mowing of the landfill cap. Also as part of the restoration work, limited public access is provided via short pathways connected to the recreational trail that runs through the site, and informational plaques have been installed along the pathways regarding the site history and remediation.

EPA approved the revised O&M Plan in December 2012.

Groundwater Collection and Treatment

Prior to the construction and implementation of the groundwater collection trench and wetland treatment system, the groundwater remedy for OU2 included a limited groundwater extraction (3 wells) and a small capacity wastewater treatment plant (Phase 1). During this period, a local company, On-Site Health and Safety Services, Inc., was contracted by ARCO to monitor and maintain the remedial systems. In addition to performing activities related to the groundwater treatment system, daily site inspections were performed including visual monitoring of the river surface for LNAPL. Monitoring wells were sampled annually and the analyzed data presented to EPA in an annual report. This report was used to show general trends over time of the effects of the remedial systems on site contamination. Monitoring of these systems led to the determination that Phase 1 was not effective in meeting the groundwater cleanup goals and that a Phase 2 system was required. In addition to constructing the groundwater collection trench and wetland

treatment system, Phase 2 also removed the LNAPL sources from the riverbank and riverbed and main drainage swale. OU2 O&M activities now pertain to the Phase 2 work, replacing the Phase 1 activities.

The Phase 2-1 wetland treatment system became operational in December 2008. At that time, the Phase 1 groundwater extraction wells and wastewater treatment system was terminated and decommissioned. Modifications were made to optimize the Phase 2-1 system during the initial six months and, with the exception of short periods of shutdown for maintenance, the system has operated continuously since June 2009. The system is shut down for two weeks in June of each year for iron solids removal from the sedimentation pond. In 2008, NYSDEC issued interim reporting limits for a new permitted outfall from the wetland treatment system. Since its issuance, several extensions of the interim draft permit have been granted to ARCO in order to optimize the efficiency of the wetland treatment system. A final permit is pending.

Additionally, since the initiation of the Phase 2-1 groundwater treatment system, ARCO has conducted a performance based groundwater monitoring (PBGM) program to ensure that an inward gradient is maintained by the groundwater collection trench. The PBGM program includes taking regular water level measurements from piezometers on the upgradient and downgradient side of the trench to confirm the inward gradient, establishing that groundwater does not migrate beyond the trench to the Genesee River. Water quality samples are also taken and analyzed from the manholes associated with the pumps in the trench to monitor contaminant levels in the influent entering the wetland treatment system. Manhole groundwater sampling and analysis is representative of site-wide upgradient groundwater quality; once constituent levels begin to diminish in the manhole samples, upgradient groundwater samples will be taken and analyzed to confirm that contaminant levels are diminishing in the aquifer. Once a trend is established, ARCO will present the regulatory agencies with a Contingency Measure Plan and/or Long-term Management Measure Plan in accordance with the terms of the UAO, establishing the groundwork for completion. The PBGM program has been incorporated into the revised site O&M Plan, finalized in 2012.

In addition to groundwater, the OU2 ROD also called for the long-term monitoring of surface water and soil gas to track any potential contaminant migration from the subsurface soils. The surface water monitoring directly led to the Phase 2-2 work to mitigate LNAPL outbreaks on the surface water of the Genesee River and main drainage swale. As described above, this work was completed in 2010. O&M activities associated with the river and swale systems include continued visual inspection particularly for signs of erosion or sloughing and effecting repairs as needed. LNAPL outbreaks have not been documented since the remedial activities concluded; however, monitoring will continue to include the recording of any outbreaks as part of the inspection process. These O&M activities and potential corrective actions are outlined in the revised site O&M Plan.

With respect to soil gas monitoring, a soil gas survey was carried out in 1993, in which EPA surveyed the buildings on-site with the New York State Department of Health. Only one building at the site was found to have a basement which would potentially be impacted by soil gas. The building is owned by the State University of New York. The basement of this building is a boiler room, consisting of a boiler and mechanical heat conveyance devices and no further action was considered necessary. Furthermore, as part of an agency wide initiative to investigate the potential for soil vapor intrusion on all Superfund sites, in 2009 outreach was made to all of the entities occupying the site offering EPA's services in conducting air monitoring in their facilities. Each entity declined to participate, citing that indoor air monitoring was routinely conducted at their facilities under OSHA guidelines. Despite this occurance, the 2012 site

management plan requires that new building construction at the site include a vapor intrusion evaluation and that vapor mitigation measures, if necessary, be included in the building design.

There have been no changes at the Site as the result of natural disasters or climate change impacts.

III. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The implemented remedy for OU1 of the Sinclair Refinery Superfund site protects human health and the environment. 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 implemented engineered and institutional controls are properly operated, monitored, and maintained.
2	Short-term Protective	The implemented remedy for OU2 of the Sinclair Refinery Superfund site protects human health and the environment in the short-term. In order for the remedy to be protective in the long-term, environmental easements/covenants need to be implemented at nine properties.
Sitewide	Short-term Protective	The implemented remedy for the Sinclair Refinery Superfund site protects human health and the environment in the short-term. In order for the remedy to be protective in the long-term, environmental easements/covenants need to be implemented at nine properties.

Table 2: Status of Recommendations from the 2012 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
2	ICs on remaining (9) site properties not filed	Finalize and file ICs on all site properties	Completed	Task was completed in October 2014	10/8/2014

[Note: As explained above in the ICs section of this report, the 2012 FYR identified ten properties which required easements; one of these ten property owners relocated to a property off-site and the former space was taken over by a current property owner, thereby reducing the total number of required easements to nine.]

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On November 14, 2016, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 38 Superfund sites in New York and New Jersey, including the Sinclair Refinery site. The announcement can be found at the following web address: https://www.epa.gov/sites/production/files/2016-11/documents/five_year_reviews_fy2017_final.pdf. In addition to this notification, a public notice was made available by posting on the Wellsville municipal website a public notice titled "U.S. Environmental Protection Agency Reviews Cleanup at the Sinclair Refinery Superfund Site" on 4/20/2017, stating that there was a FYR and inviting the public to submit any comments to the U.S. EPA. The results of the review and the report will be made available at the Site information repository located at the David A. Howe Memorial Library, 155 North Main Street, Wellsville, NY.

Data Review

Data collected for this FYR period (2012-2016) included operations, maintenance and monitoring data contained in O&M annual reports for OU1/OU2. The type of data collected and transcribed in these reports include inspection results, settlement plate survey results, groundwater, slurry wall, and LNAPL elevation/thickness measurements, groundwater quality analysis, gas vent and storm water evaluations, soil pH and agronomic testing results, and a summary of maintenance activities performed. Additionally visual observations are conducted of the surface water bodies at the site (Genesee River and main drainage swale) to ensure that there are no longer LNAPL seeps from the site impacting surface water.

Groundwater quality monitoring performed under OU1 includes biennial sampling and analysis of the eleven wells outside the slurry wall forming the perimeter of the CELA. Results indicate that VOC and SVOC levels remain below MCLs in these wells and the few samples where metals exceeded the MCL indicated either stable or decreasing concentration trends. Semi-annual groundwater elevation monitoring data indicate that water levels within the CELA have remained stable and are consistently more than one foot below the top of the slurry wall.

Other data collected during the five-year period since the last review included the hydraulic data contained in two PBGM reports, dated December 2014 and December 2015, which provide an evaluation of the performance of the groundwater collection trench. The hydraulic data was collected from piezometers located on either side of the collection trench. Groundwater elevations demonstrate that an inward gradient is achieved by the trench, achieving the desired result of capturing site groundwater from either side of the trench as designed. Other hydraulic data contained in the reports include manhole pump rates and efficiency results and water level control berm groundwater flow paths. These data, too, support that the Phase 2-1 groundwater system is operating as designed.

Groundwater quality monitoring associated with the groundwater recovery system includes quarterly sampling and analysis of recovery trench manholes. Beginning in 2010, when the Phase 2 groundwater remedy was activated, groundwater quality data was obtained by analyzing samples taken from the manholes in the groundwater collection trench. These data provide a representation of site-wide groundwater quality while also representing influent to the wetland treatment system. An analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and arsenic levels in groundwater representing the period from the last FYR to the current one, does not show any discernible trends. BTEX and arsenic

levels rose, declined, or remained constant during this period and were consistent with historic patterns. There appears to be some correlation between seasonal water level and concentrations (relatively higher concentrations reported in seasonal high groundwater); this is likely attributed to fluctuations in the water table over the period that enable some discrete introductions of contaminants from the vadose zone into the groundwater.

Groundwater quality analysis in the manholes during the FYR period varied by location and season. BTEX concentration in the manholes ranged from not detected (in manholes D and E) to 127.1 ppb (in manhole C). The presence of BTEX in the manholes generally corresponds to the locations of the groundwater plumes identified in the OU2 RI/FS report. Similarly arsenic concentrations in the manholes range from not detected (in manholes D and H) to 911 ppb (in manhole A). The presence of arsenic in the manholes also generally corresponds to the locations of the groundwater plumes identified in the OU2 RI/FS report. Appendix B, Table 1 provides a summary of groundwater quality data collected from 2012 through 2015 in the manholes.

Groundwater quality monitoring related to the recovery system also involves annual sampling and analysis of four monitoring wells (MW-55R, MW-71, MW-78 and OW-04) located down gradient of the recovery trench. Laboratory analysis of groundwater samples was conducted for select SVOCs and VOCs as required by the O&M Plan. It should be noted that 2013 was the first year of groundwater monitoring conducted in accordance with the current O&M Plan. Prior to 2013, the most recent sampling of these wells was conducted in 2009 under a different monitoring program and parameter list.

Between 2013 and 2015, SVOCs and VOCs were reported in groundwater samples at low levels or as not detected in the four monitoring wells. For well W-55R, low levels of acenaphthene and fluorene were reported at 0.64 ppb and 0.64 ppb, respectively, in 2014. For well OW-04, aniline was reported at a maximum of 400 ppb in 2014 and nitrobenzene was reported at a maximum of 69 ppb in the same year. Also, low levels of benzene (5.1 ppb), ethylbenzene (6.4 ppb), toluene (0.84 ppb), and total xylene (1.8 ppb) were observed in well MW-55R in 2014. In general, VOC and SVOC analytical results are comparable to historic results. Appendix B, Table 2 provides a summary of groundwater quality data collected from 2013 through 2015 in the downgradient monitoring wells.

Finally, monthly data are collected and provided in letter report format to meet the requirements of the permitted outfall at the head of the main drainage swale, representing post-treatment effluent. The parameters are established in the discharge permit and include physical (flow rates, pH, suspended solids) as well as chemical (site constituents of concern, including VOCs, SVOCs, and metals) characteristics. These monthly results confirm the effective treatment of groundwater by the wetland treatment system and that the system is operating as designed.

Visual inspection of the Genesee River and main drainage swale confirm that the remedial actions completed in 2011 to mitigate LNAPL seeps remain effective.

Site Inspection

The inspection of the Site was conducted on 6/6/2017. In attendance were Peter Lisichenko, EPA On-Scene Coordinator, Maurice Moore, NYSDEC Project Manager, and Mary Wojciechowski, ARCO/BP Project Manager. Representatives of On-Site Health and Safety, BP's O&M contractor, were also present during the inspection. The purpose of the inspection was to assess the protectiveness of the remedy.

During the site inspection, there were no problems or deviations observed with respect to the ongoing operation and maintenance activities.

V. TECHNICAL ASSESSMENT

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

Question A Summary:

The landfill cap, drainage system, and monitoring wells are intact and in good repair. The landfill and associated systems are inspected routinely and actions are taken where and when appropriate in accordance with the O&M manual. Groundwater quality monitoring data for OU1 indicate that VOC and SVOC levels in the wells along the outside perimeter of the landfill remain below MCLs and either a stable or decreasing concentration trend for metals in the few sample locations where metals exceeded the MCL. Groundwater elevation monitoring data indicate that water levels within the landfill have remained stable and are consistently more than one foot below the top of the slurry wall. Modifications to the OU1 O&M manual were incorporated into the revised site-wide O&M Plan. The modifications account for the restoration of the CELA surface using wildflowers and native grass species, eliminating the need for mowing of the landfill cap. Also the recreational trail that runs through the site, and informational plaques have been installed for the public's edification regarding the site history and remediation. The revised site-wide O&M Plan was finalized in 2012.

The 1991 ROD called for excavation and disposal of surface soils exceeding remedial cleanup criteria for arsenic and lead, extraction/treatment of contaminated site groundwater, and monitoring of surface water, groundwater, groundwater seeps, and indigenous biota residing in the main drainage swale. The soil excavation and disposal component of the remedy was completed in 1994 and resulted in the removal of 15,000 cubic yards of contaminated soils, most of which were placed under the landfill cap. Post-excavation sampling confirmed that potential exposure to arsenic and lead in surface soils has been mitigated in accordance with the decision document and design specifications. Additionally, subsurface contamination remaining beneath building foundations and parking lots at the site is accounted for in institutional controls which have been implemented site-wide to ensure proper handling and disposal of wastes should impacted subsurface soils be disturbed.

A Phase 1 groundwater treatment remedy was initiated in 1993. The Phase 1 groundwater remedy involved an air sparging and soil vapor extraction operation that was to be implemented on a trial basis along with a limited groundwater pumping and treatment component. Although the remedy resulted in the removal of 160,000 pounds of petroleum hydrocarbons, EPA determined that ARARs were not being met following a performance evaluation of the remedy system in 2002. Consequently, Phase 1 was terminated in 2003 and the design of a Phase 2-1 groundwater remedy, consisting of site-wide extraction and treatment of contaminated groundwater, began. The groundwater treatment system was further modified, as per an ESD completed in 2009, to provide for a site-long groundwater collection trench and engineered wetlands as a treatment facility. Construction of the system was completed in 2008 and the system has since been operational.

The groundwater treatment system in place consists of a collection trench that intercepts impacted groundwater from the glacial drift aquifer at the site and prevents migration of contaminated water to the Genesee River by creating a groundwater divide between the trench and the river. Site-wide groundwater

capture is maintained by pumping the trench from sumps in eight manholes. There are numerous piezometers installed adjacent to the trench and thirteen staff gauges installed along the river that are used to continually monitor the hydraulics of the system. Pumping manholes and wells are also used to monitor the quality of collected groundwater. The intercepted groundwater is conveyed to a constructed wetlands located at the southern end of the site, where contaminated water is treated by natural processes. The constructed wetlands duplicate the functions of solids removal, air stripping, and carbon adsorption that are provided by devices used in more conventional water treatment facilities.

Based on the last several years of water-level data from the site, the system appears to function properly. Hydraulic gradients are maintained toward the trench. Pumping in the trench is sufficiently adequate to maintain capture on both sides of the trench. Water quality data from monitoring wells and manholes show various concentrations of VOCs, SVOCs, and metals with no discernible trends yet apparent. This is expected to change over time, with declining chemical concentrations expected as the Phase 2 groundwater system operates over time. Review of effluent data from the point source permitted outfall meets the discharge criteria, supporting that the wetland treatment system effectively treats the groundwater as intended.

The site remedy also includes a source control component to address discrete areas of LNAPL located in the riverbank and riverbed, and along the embankment of main drainage swale that were identified by monitoring and subsequent supplemental investigations during the 2001-2003 period.

A Phase 2-2 program was designed and completed in the spring of 2009 that was used to mitigate sediment and soil contamination through removal of LNAPL contaminated material from the riverbank, riverbed, and main drainage swale. This work was completed in 2010. Monitoring of the river channel and main drainage swale are included in the comprehensive O&M Plan for the site that was put into effect after the plan was finalized. Visual inspection of the Genesee River and main drainage swale confirm that the remedial actions completed in 2011 to mitigate LNAPL seeps remain effective.

Environmental restrictions have been placed on all of the site properties to ensure the integrity of the remedy and provide requirements for the continued protection of human health and the environment.

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

Question B Summary:

There have been no changes in the physical conditions of the site since the last FYR that would change the protectiveness of the remedy. Currently, most of the site is occupied by the State University of New York at Alfred's Wellsville Campus. Other site occupants include a small manufacturing/technology company, a truck depot, a power transmission right-of-way, and a public recreational trail. The site includes approximately 30 structures made of either brick or corrugated aluminum and steel frame construction. The landfill portion of the site is capped and drinking water is provided to all buildings onsite from the Village of Wellsville's public water supply. The property is zoned industrial, which is not expected to change.

Risk Assessment Evaluation

At the time of the OU1 ROD, the procedures, guidance, and policies regarding human health risk assessment were under development. The ROD for OU1 identified elevated levels of lead and arsenic in

the pools atop the landfill and in the main drainage swale, which suggested that surface water runoff may transport the metals to these local depressions and possibly to the Genesee River. The most significant threat from the landfill was determined to be from flooding or failure of the landfill slopes. Failure of the landfill into the Genesee River would have a serious negative impact on public health and the environment. Additionally, localized organic compound vaporization was found to be a potential contaminant migration mechanism, and thereby a potential threat to the local population. This information served as the OU1 human health risk assessment.

The risk assessment for OU2 was conducted in 1991. The assessment evaluated the following potential exposures: (1) inhalation of fugitive dust; (2) inhalation of volatile emissions from subsurface soil; (3) ingestion of surface water; (4) ingestion of surface soil; (5) ingestion of former tank farm surface soil; and (6) ingestion of subsurface soil. Risks were quantified for each of these scenarios for the following receptors: (1) adults on-site and in Wellsville; (2) children on-site; (3) excavation workers on-site; and (4) children on the off-site former tank farm and in Wellsville. In general, the exposure assumptions, pathways, and receptors along with the toxicity information used to estimate the potential risks and hazards to human health followed EPA guidance and the assumptions are still valid.

Soil

The HHRA for OU2 identified the inhalation of fugitive dust, primarily due to arsenic in surface soil, as the greatest risk factor. As a result, a risk-based arsenic cleanup goal of 25 ppm was generated. EPA is currently evaluating arsenic toxicity through the Integrated Risk Information System process that provides EPA's consensus toxicity values. The original arsenic cleanup goal, however, is below the HI = 1 for residential and industrial exposures and within the risk range of 10-4 to 10-6 established under the National Contingency Plan for all anticipated current and future receptors. Thus, the remedy is protective of exposures under the outdoor worker scenario for industrial land use and, therefore, protective of a college student with potential exposures for a shorter time frame than an outdoor worker (i.e., 180 days/year for 4 years for the college student compared to 225 days/year for a period of 25 years for the adult outdoor worker). Any changes to the toxicity evaluation of arsenic will need to be addressed during the next FYR.

EPA issued a lead memorandum in December 2016 (OLEM Directive 9200.2-167) which indicates that a blood lead level (BLL) of 10 ug/dL is no longer considered health-protective. Current scientific information indicates that adverse health effects are evident with BLLs between 2 and 8 ug/dL. A target BLL of 5 ug/dL reflects current scientific literature on lead toxicology and epidemiology that provides evidence that the adverse health effects of lead exposure do not have a threshold. The soil lead cleanup goal for industrial properties in 1991 was 1,000 ppm, based on OSWER Directive 9355-4-02, as discussed in Section II, and was applied at this site. Using a target BLL of 5 ug/dL results in a cleanup goal of 800 ppm for the outdoor worker. Post-excavation data at the site indicate that although the cleanup goal was higher, the average concentration of lead across the remediated areas of the site is less than 800 ppm. Only one post-excavation confirmatory sample exceeded 800 ppm for lead (duplicate sample CC70A was 870 ppm); all other confirmatory samples for lead were considerably lower. Confirmatory sampling results associated with the refinery surface soils remedial action appear on Table 7 of the October 1994 "Remedial Action Report, Contaminated Surface Soils" by GeoSyntec Consultants for ARCO.

The remedial actions conducted to address lead and arsenic at the site have interrupted potential direct contact exposures. The combination of contaminated soil removal, landfill cap installation, walking area designation, IC implementation, and the ongoing O&M provide effective barriers to contaminated soil

exposure. As such, review of the toxicity data for arsenic and lead indicate that the remediation goals remain protective based on current toxicity data for these chemicals under an industrial land use scenario.

Groundwater

Groundwater contamination is being addressed under OU2. The Genesee River is a local source of municipal drinking water. The intake for the Village of Wellsville municipal water supply is located approximately one-quarter mile upstream of the site and is, therefore, not impacted by the site. Although site groundwater is classified as a potable source (Class GA), drinking water is supplied by the Village of Wellsville municipal system.

The 1991 ROD established the federal MCLs and NYSDEC Class GA groundwater standards as the cleanup criteria for site groundwater. Since the ROD was issued, the MCL for arsenic was changed from 50 ppb to 10 ppb as acknowledged in the 2002, 2007, and 2012 Five-Year Review Reports. The toxicity values for several other chemicals of concern have been updated since the 1991 ROD as well; however, these changes would not impact the remedial decision, cleanup criteria chosen for the site, or protectiveness of the remedy. The EPA MCLs and NYSDEC Class GA groundwater standards remain protective of human health.

Soil Vapor Intrusion

Soil vapor intrusion (SVI) was evaluated during the 2007 FYR. As a result of that analysis, in 2009, EPA contacted the site occupants offering to conduct facility vapor intrusion investigations. Each entity, however, declined to participate. Despite this occurance, the 2012 site management plan requires that new building construction at the site include a vapor intrusion evaluation and that vapor mitigation measures, if necessary, be included in the building design.

<u>Ecological Risk Assessment Evaluation</u>

The remedy has eliminated exposure to ecological receptors by controlling the source of contamination.

An ecological risk assessment was conducted as part of the 2004 main drainage swale investigation and provided data to assist in the development of the cleanup levels in the Phase 2-2 remedial design. Although the exposure assumptions and toxicity assessment conducted for the 2004 investigation may not necessarily reflect the current ecological risk assessment methodology, the remedy is protective of ecological resources as contaminated sediments and soil were dredged/excavated and contained within a secure covered landfill. Further, as the groundwater treatment system is functioning as intended, the contaminant pathway to the Genesee River and the main drainage swale has been removed.

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

No other information has come to light that would call into question the protectiveness of the remedy. There have been no changes at the Site as the result of natural disasters or climate change impacts.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1, OU2

VII. PROTECTIVNESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: OU1, OU2	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The implemented remedy for the Sinclair Refinery Superfund site is protective of human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The implemented remedy for the Sinclair Refinery Superfund site is protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Sinclair Refinery Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

OU1 Record of Decision, EPA, September 1985;
OU2 Record of Decision, EPA, September 1991;
Explanation of Significant Differences, EPA, August 2009;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Educational Foundation of Alfred to ARCO on July 7, 2011;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Educational Foundation of Alfred to ARCO on July 25, 2011;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Village of Wellsville to ARCO on October 7, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Town of Wellsville to ARCO on October 7, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Allegany County Industrial Development Agency to ARCO on October 7, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Allegany Trails Inc. to ARCO on October 7, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Current Controls Inc. to ARCO on October 7, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Otis Eastern Service Inc. to ARCO on October 9, 2013;
Environmental Protection Easement and Declaration of Restrictive Covenants granted by Niagara Mohawk Power Corporation to ARCO on October 8, 2014;
Sinclair Refinery Site Five-Year Review Report, September 2012;
2012 Annual Report of Operations, Maintenance and Monitoring, Operable Units One & Two; Sinclair Refinery Site, December 2013;
2013 Annual Report of Operations, Maintenance and Monitoring, Operable Units One & Two; Sinclair Refinery Site, December 2014;
2014 Annual Report of Operations, Maintenance and Monitoring, Operable Units One & Two; Sinclair Refinery Site, December 2015;
2015 Annual Report of Operations, Maintenance and Monitoring, Operable Units One & Two; Sinclair Refinery Site, December 2016; and
Monthly Effluent Sampling Analysis Reports, August 2012 through November 2016.

APPENDIX B – GROUNDWATER TABLES

Table 1: Groundwater Quality Trend Analysis Measured in Trench Manholes 2012-2015

Sampling Event	Manhole A	Manhole B	Manhole C	Manhole D	Manhole E	Manhole F	Manhole G	Manhole H
April 2012	BTEX: 36.8* Arsenic: 131	BTEX: 45.8 Arsenic: 158	BTEX: 77.7 Arsenic: 74.9	BTEX: ND Arsenic: 12.3	BTEX: ND Arsenic: 33.7	BTEX: 15.1 Arsenic: 44.7	BTEX: 44.5 Arsenic: 35.8	BTEX: 101.3 Arsenic: 43.2
October 2012	BTEX: 49.6 Arsenic: 174	BTEX: 39.2 Arsenic: 116	BTEX: 71.7 Arsenic: 105	BTEX: ND Arsenic: 16.5	BTEX: ND Arsenic: 45.3	BTEX: 10.9 Arsenic: 57.3	BTEX: 17.5 Arsenic: 37.4	BTEX: 31.0 Arsenic: 16.6
April 2013	BTEX: 38.3 Arsenic: 145	BTEX: 42.5 Arsenic: 125	BTEX: 77.7 Arsenic: 74.9	BTEX: ND Arsenic: 12.3	BTEX: ND Arsenic: 33.7	BTEX: 15.1 Arsenic: 44.7	BTEX: 44.5 Arsenic: 35.8	BTEX: 100.1 Arsenic: 41.3
October 2013	BTEX: 52.6 Arsenic: 181	BTEX: 45.0 Arsenic: 123	BTEX: 103.7 Arsenic: 98.6	BTEX: ND Arsenic: 21.6	BTEX: 22.1 Arsenic: 47.8	BTEX: 16.0 Arsenic: 61.7	BTEX: 35.4 Arsenic: 50.9	BTEX: 98.9 Arsenic: 49.0
April 2014	BTEX: 30.6 Arsenic: 115	BTEX: 36.2 Arsenic: 114	BTEX: 60.9 Arsenic: 38.1	BTEX: 00.1 Arsenic: ND	BTEX: 0.59 Arsenic: 23.0	BTEX: 12.15 Arsenic: 30.1	BTEX: 57.9 Arsenic: 44.8	BTEX: 63.8 Arsenic: 21.1
October 2014	BTEX: 36.6 Arsenic: 163	BTEX: 37.3 Arsenic: 186	BTEX: 127.1 Arsenic: 28.1	BTEX: ND Arsenic: ND	BTEX: 0.96 Arsenic: 45.2	BTEX: 13.76 Arsenic: 52.2	BTEX: 27.4 Arsenic: 41.1	BTEX: ND Arsenic: ND

April 2015	BTEX: 27.8 Arsenic: 911	BTEX: 32.7 Arsenic: 399	BTEX: 56.8 Arsenic: 53.4	BTEX: ND Arsenic: 11.1	BTEX: 1.14 Arsenic: 21.4	BTEX: 12.47 Arsenic: 40.9	BTEX: 43.0 Arsenic: 45.5	BTEX: 6.92 Arsenic: ND
October 2015	BTEX: 27.6 Arsenic: 185	BTEX: 27.6 Arsenic: 884	BTEX: 73.9 Arsenic: 140	BTEX: ND Arsenic: 17.9	BTEX: 0.34 Arsenic: 43.2	BTEX: 15.6 Arsenic: 54.7	BTEX: 23.6 Arsenic: 45.5	BTEX: 38.6 Arsenic: 39.1

*All values reported in parts per billion (ppb) / ND=not detected

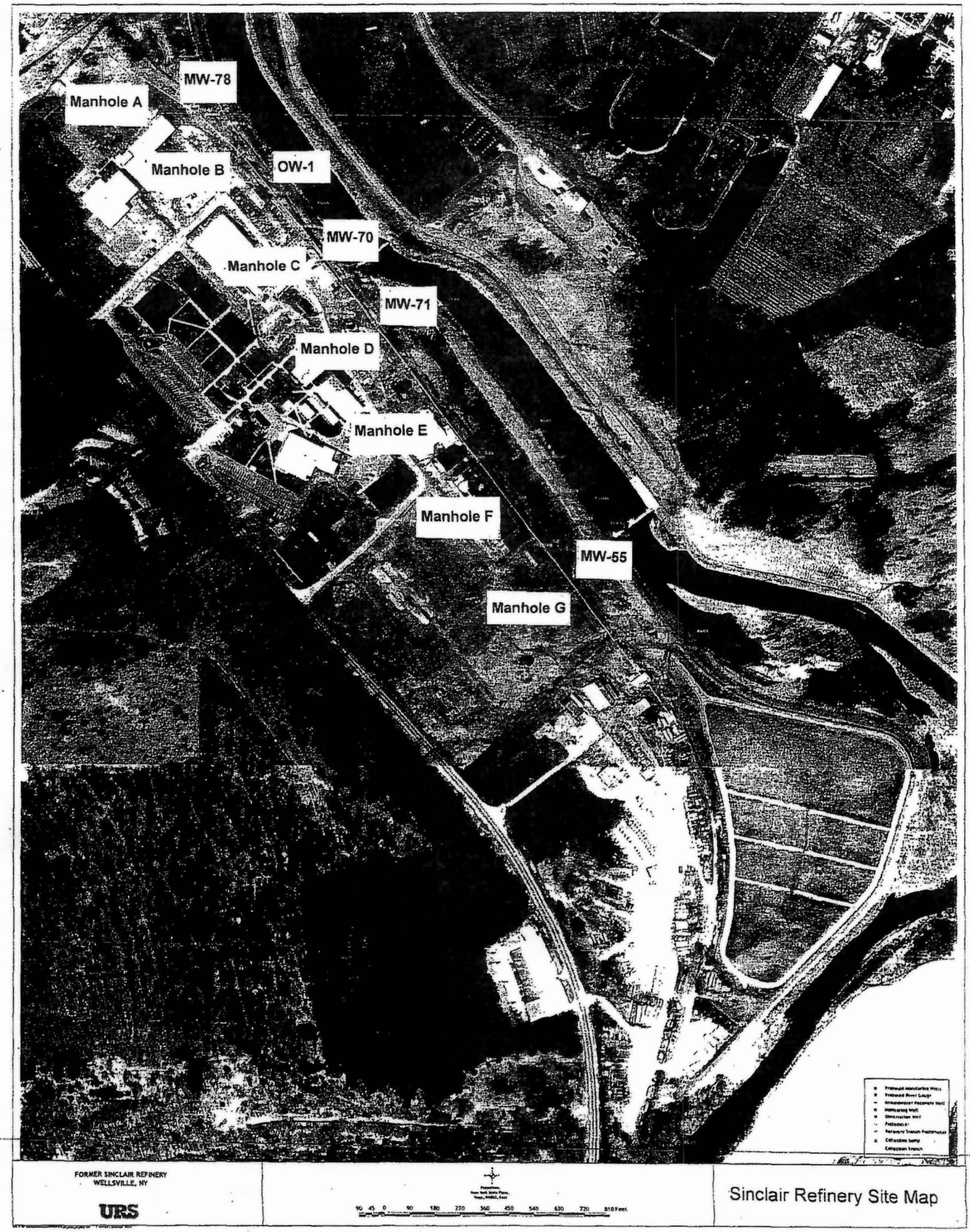
Table 2: Groundwater Quality Trend Analysis in Downgradient Monitoring Wells 2013-2015

	Monitoring Well MW-55R	Monitoring Well MW-71	Monitoring Well MW-78	Monitoring Well OW-4
Sampling Event				
2013	Benzene: 2.5* Toluene: 0.14 Ethylbenzene:0.41 Xylenes: 0.23	Benzene: ND Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: 0.99 Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: ND Toluene: ND Ethylbenzene: ND Xylenes: ND
2014	Benzene: 5.1 Toluene: 0.84 Ethylbenzene: 6.4 Xylenes: 1.8	Benzene: ND Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: 0.58 Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: ND Toluene: 0.28 Ethylbenzene: ND Xylenes: ND
2015	Benzene: 0.13 Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: ND Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: 0.93 Toluene: ND Ethylbenzene: ND Xylenes: ND	Benzene: ND Toluene: ND Ethylbenzene: ND Xylenes: ND

*All values reported in parts per billion (ppb) / ND=not detected

APPENDIX C - SITE MAP

Figure 1


MW-78
Manhole A
Manhole B
OW-1
MW-70
Manhole C
MW-71
Manhole D
Manhole E
Manhole F
MW-55
Manhole G
FORMER SINCLAIR REFINERY
WELLSVILLE, NY
URS
90 45 0 90 180 270 360 450 540 630 720 810 Feet
Sinclair Refinery Site Map