Superfund Proposed Plan

Wolff-Alport Chemical Company Superfund Site

Queens County, New York

EPA

July 2017

PURPOSE OF THIS DOCUMENT

This document describes the remedial alternatives considered for the Wolff-Alport Chemical Company (WACC) Superfund site (Site) and identifies the preferred remedy with the rationale for this preference. This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA) in consultation with the New York State Department of Environmental Conservation (NYSDEC) and other federal, state, and local governmental stakeholders. EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of the contamination at the Site and the remedial alternatives summarized in this Proposed Plan are described in the July 2017 remedial investigation (RI) and feasibility study (FS) reports, respectively. EPA encourages the public to review these documents to gain a more comprehensive understanding of the site and the Superfund activities that have been conducted at the Site.

This Proposed Plan is being provided as a supplement to the RI/FS reports to inform the public of EPA's preferred remedy and to solicit public comments pertaining to all of the remedial alternatives evaluated, including the preferred alternative. The preferred remedy consists of permanent relocation of the tenants, demolition of the former WACC buildings, contaminated soil excavation, contaminated sewer removal/cleaning, and off-Site disposal of the contaminated soils and debris.

The remedy described in this Proposed Plan is the preferred remedy for the Site. Changes to the preferred remedy, or a change from the preferred remedy to another remedy, may be made if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting public comment on all of the alternatives considered in the Proposed Plan and in the detailed analysis section of the RI/FS report because EPA may ultimately select a remedy other than the preferred remedy.

MARK YOUR CALENDAR

July 28, 2017 – August 28, 2017*: Public comment period related to this Proposed Plan.*

August 16 at 7:00 P.M.: *Public meeting at Audrey Johnson Day Care Center, 272 Moffat Street, Brooklyn, NY.*

Copies of supporting documentation are available at the following information repositories:

Washington Irving Library
360 Irving Avenue (at Woodbine St.)
Brooklyn, NY 11237
718-628-8378
and
EPA-Region II
Superfund Records Center
290 Broadway, 18th Floor
New York, NY 10007-1866
212-637-4308

EPA relies on public input to ensure that the concerns of the community are considered in selecting an effective remedy at Superfund sites. To this end, the RI and FS reports and this Proposed Plan have been made available to the public for a public comment period that begins on July 28, 2017 and concludes on August 28, 2017.

A public meeting will be held (see the date and location in the textbox, above) to present the conclusions of the RI/FS, elaborate further on the reasons for recommending the preferred remedy, and receive public comments.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD), the latter being the document that formalizes the selection of a remedy.

COMMUNITY ROLE IN SELECTION PROCESS

Written comments on the Proposed Plan should be addressed to:

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SCOPE AND ROLE OF ACTION

The primary objectives of this action are to address the soil, sewer, and building material contamination, and minimize the migration of contaminants through surface runoff, dust migration, and sewer discharge.

SITE BACKGROUND

Site Description

The Site comprises an area of radiological contamination at 1127 Irving Avenue in Ridgewood, Queens, New York on the border of Bushwick, Brooklyn. The Site includes the former WACC property, a roughly triangular area of approximately 0.75 acres that is now subdivided into several commercial properties, as well as adjacent areas including streets, sidewalks, commercial and residential properties, and the sewer system where contaminants have migrated, or have the potential to migrate, in the future. A Site location map is provided as Figure 1. Figure 2 shows the general area, including the sewers.

The former WACC property is bound by Irving Avenue to the southwest, Cooper Avenue to the northwest, and a commercial property to the east. At present, the property is covered with contiguous structures, except along its eastern edge in an area which was formerly used as a rail spur. The neighborhoods surrounding the former WACC property contain light industry, commercial businesses, residences, a school, and a daycare center. An active rail line passes within 125 feet to the southeast of the property.

The on-Site commercial properties include a gravel-covered former rail spur used to store automobiles (Lot 31), a one-story dilapidated warehouse, which is currently unoccupied (Lot 33), a subdivided one-story building primarily used for storage and occupied by a construction company and an auto body shop with an adjoining office (Lot 42), a one-story building occupied by a motorcycle repair shop (Lot 44), a two-story building housing a delicatessen, office space, and three unoccupied residential apartments, as well as an attached one-story building housing a tire shop (Lot 46), and a one-story building housing an auto repair shop and office space (Lot 48).

Site History

WACC operated at the property from the 1920s until 1954, importing monazite sand via rail and extracting rare earth metals from the material. Monazite sand contains approximately 6-8% or more of thorium and 0.1-0.3% of uranium. The acid treatment process used by WACC converted the phosphate and metal component of the monazite to aqueous species, rendering the rare earth materials extractable while dissolving the thorium and uranium in an acid, such as sulfuric and nitric acid, generating waste process-liquors and tailings. This process concentrated thorium-232 (Th-232) and uranium-238 (U-238), both of which are radioactive, in the process liquors.

During its operation, WACC occupied three structures which currently comprise Lots 42 and 44. WACC's operation included two yard areas--one between the buildings on Lot 42 and the other on the eastern end of the property at the northern end of Moffat Street. These areas were reportedly used as staging areas for monazite sands or waste tailings containing Th-232 and U-238. The waste tailings were likely spread or buried on the property. WACC disposed of the liquid process wastes into the sewer. According to the U.S. Department of Energy, the Atomic Energy Commission (AEC) ordered WACC to halt sewer disposal of thorium waste in the fall of 1947. Thereafter, thorium was precipitated as thorium oxalate sludge and sold to the AEC.

Initial scoping-level radiological surveys performed by NYSDEC, New York City Department of Health and Mental Hygiene (NYCDOHMH), and EPA in 2007 found radiological impacts throughout the WACC property and the nearby sewer. Follow-up investigations by the New York City Department of Design and Construction (NYCDDC) in 2009-2010 found waste tailings consisting of black or gray ash-like material in a contaminated soil layer beneath the WACC property buildings, sidewalks, and asphalt surfaces of Irving Avenue and Moffat Street, and in the surface soils of the former rail spur. Elevated Th-232 concentrations were found in soil samples containing tailings. During the NYCDDC investigation, elevated levels of thoron and radon gas were detected in the deli basement.

In February 2012, the Agency for Toxic Substances and Disease Registry (ATSDR) issued a Health Consultation which noted that exposure to the residual radioactive contamination at the Site may pose a health threat under certain long-term exposure scenarios. Based on the ATSDR document, EPA prepared a Removal Site Evaluation for the Site in August 2012 to determine whether an immediate response action (*i.e.,* a removal action) was necessary. In September 2012, EPA collected gamma radiation exposure rate measurements and thoron and radon concentration measurements on and around the perimeter of the suspected source area and at background locations. The gamma radiation exposure rate measurements identified hot spots along the former rail spur and in the sidewalks and streets adjacent to the former facility and elevated radon concentrations in two of the on-site businesses.

Based upon this evaluation, EPA conducted a removal action between October 2012 and April 2014 which consisted of a gamma radiation[1] assessment and radon sampling at the Site, the installation of a radon mitigation system in one on-Site building where radon concentrations exceeded EPA's guidance level of 4 picocuries per liter (pCi/L), and the installation of lead, steel, and concrete shielding in certain areas of the Site, based on recommendations collaboratively developed by EPA and NYCDOHMH. Gamma exposure rates were observed to have been reduced between 60-95% based on a comparison of pre-shielding and post-shielding gamma radiation surveys but not below the regulatory dose rate limit promulgated in 40 CFR Part 192.12 (b)(2).

In July 2013, EPA, New York State Department of Health (NYSDOH), and NYCDOHMH conducted a radiological assessment of the neighborhood within a half-mile radius of the Site. The data collected during this assessment indicated that there is no exposure to the surrounding community from radiological contaminants located on-Site.

The Site was included on the National Priorities List on May 12, 2014.

Site Geology

The Site is at an elevation of approximately 70 feet above mean sea level (msl), and the ground surface in the area generally slopes gently to the southwest. The eastern edge of the Site is adjacent to an elevated rail line that runs parallel to Moffat Street. The ground surface rises sharply toward the rail line and continues to rise to a cemetery, east of the Site, to elevations as high as 160 feet above msl.

While drilling at the Site, EPA encountered two types of unconsolidated material--fill and Upper Glacial Aquifer deposits (till and outwash). Fill near the former WACC property is typically 5-15 feet thick and is generally characterized by the presence of man-made materials (bricks, coal, various building materials) intermixed with silt, sands, and gravels. Much of the upper layers of the fill in borings at the former WACC property, as well as some borings to the south on Moffat Street, consisted of a black, gray, and/or white cinder or ash-like material. This material, which is likely waste tailings, was found between 0-4 feet below ground surface (bgs) near the former WACC property and between 0-6 feet bgs along Moffat Street.

Upper Glacial Aquifer deposits were encountered from the bottom of fill (0-15 feet bgs) to the base of the borings installed at the Site (75 feet bgs). The upper portion of the glacial deposits (down to approximately 25-37 feet bgs) is made up of glacial till, which is yellowish brown dense silty sand and gravel. The material underlying the glacial till is glacial outwash, slightly more uniform and coarse in texture than the till, and it extends from the bottom of the till to at least 75 feet bgs (*i.e.,* the total depth of investigation at the Site).

Depth to groundwater at the Site is about 60 feet bgs, and the direction of groundwater flow is generally to the south. Based on the available geologic literature, the base of the Upper Glacial Aquifer in this area is assumed to be the Gardiners Clay, which is present at an elevation of 100 feet below msl at the Site, or about 170 feet bgs.

NATURE AND EXTENT OF CONTAMINATION

Remedial Investigation Activities

RI field work was conducted from September 2015 to March 2017. Environmental media investigated during the RI included soil, sediment, groundwater, air, and building/sewer materials. Samples were, primarily, collected to delineate the extent of media contaminated by radioactive waste; however, samples were also analyzed to determine the presence of non-radiological contamination.

Specifically, the investigation included building material gamma surveys, building material sampling, wipe sampling, a hazardous material building survey, soil investigations, including gamma walkover surveys and soil sampling, groundwater sampling, water level measurements, hydraulic conductivity assessments, sewer investigations, including fiberscope mapping with in-sewer gamma count and gamma exposure rate

[1] Gamma radiation arises from the radioactive decay of atomic nuclei.

surveys, sewer material sampling, soil borings in the vicinity of the sewer, sediment sampling in Newtown Creek where the combined sewer overflow (CSO) discharges,[2] gamma exposure rate confirmation surveys, and school/daycare investigations, including soil sampling, gamma exposure rate surveys, and radon and thoron evaluations.

Remedial Investigation Results

The primary contaminants of concern at the Site are the radioactive isotopes Th-232, U-238, and radium-226 (Ra-226).[3] Th-232 in combination with Ra-226 were used to determine the nature and extent of contamination associated with the Site. For risk analysis and screening purposes, the U-238 concentrations are assumed to be that of the Ra-226 progeny. This is a conservative assumption in that the acid used as the agent for solubilizing the monazite ores in the rare-earth extraction process would preferentially concentrate the Ra-226 in the waste sludge. During the RI, samples were collected from building materials, air, soils,[4] sewers, and groundwater. In addition, gamma exposure rate confirmation surveys were conducted. The results of the RI are summarized below.

<u>Building Materials</u>

Radiological contamination remains in the building structures at the former WACC property, primarily, in the buildings that previously contained the kiln/vat in which monazite sands processing took place (Lots 42 and 44), in the basement of the deli (Lot 46), and, to a lesser extent, in the warehouse on Lot 33 constructed above the former yard area. Contaminants are primarily embedded in the building structure with the highest concentration of Th-232 at 415.2 picocuries per gram (pCi/g)[5] and Ra-226 at 44.2 pCi/g from a sample of brick from Lot 44. The Th-232 and Ra-226 RI screening criteria (determined from background[6] levels) for the building materials are 1.2 pCi/g and 0.9 pCi/g, respectively.

Asbestos-containing material, lead-based paint, and other hazardous materials were found in the WACC building structures, which would be expected for an industrial building of its age.

<u>Air</u>

Previous investigations found concentrations of radon and thoron above the screening criteria and EPA's guidance level of 4 pCi/L in indoor air at the former WACC property. Air sampling conducted prior to radiation mitigation activities in 2013 found the highest levels of air contamination in the buildings on Lots 42 and 44 (where the majority of WACC processing activities took place). Following the mitigation activities, the radon levels, as measured when the mitigation system was turned on, dropped to below EPA's guidance level.

<u>Soils</u>

Under the former WACC buildings, the highest concentrations of radiological contamination were encountered with a maximum concentration of 760 pCi/g found in a sample 10 to 12 feet bgs. Contamination extends to a depth of 28 feet bgs under the building on Lot 44, the former kiln/vat building, with a Th-232 concentration of 4.3 pCi/g[7] from 26 to 28 feet bgs; and to 24 feet bgs under Lot 42, the former yard where the monazite sands were loaded into the kiln/vat building for processing, with a Th-232 concentrations of 2.6 pCi/g from 22 to 24 feet bgs. The Th-232 and Ra-226 RI screening criteria for soil are 1.2 pCi/g and 0.9 pCi/g, respectively.

Surficial contamination was detected in the former rail spur area, at the intersection of Irving Avenue and Moffat Street, the northern portion of Moffat Street, the eastern portion of Irving Avenue, and in the southeastern corner of Lot 31/northern part of 350 Moffat (area adjacent to the Moffat Street/Irving Avenue intersection). The surficial contamination appears to have been, primarily, due to filling in the area with process tailings, as observed in soil borings. Other surficial contamination was likely caused by stockpiling of the monazite sands and tailings in the former storage yards, allowing rainwater to transport contamination to lower topographic areas. This also would have allowed wind to transport the particulate matter through the air, likely depositing near the former WACC property.

Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) were detected at the former WACC

[2] Combined sewers receive both sewage and stormwater flows and discharge to surface water when the sewer system's capacity is exceeded, *i.e.,* in significant storm events.

[3] Because the minimum detectable activity using gamma spectroscopy for U-238 is high, gamma spectroscopy results are not used as a first line indicator for U-238. Therefore, Ra-226, the decay progeny of U-238, is used to indicate U-238 levels.

[4] Soil samples were collected at three intervals—surficial (0-2 feet); shallow (2-10 feet); and deep (27-75 feet).

[5] The term provides an expression of how many radioactive decays are occurring per unit of time. Soils in New York State have background concentrations of Th-232 that range from 0.5 to 2 pCi/g.

[6] Background refers to substances or locations that are not influenced by the releases from a site and, therefore, can be used as a point of comparison.

[7] Background Th-232 concentrations ranged from 0.487 pCi/g to 1.132 pCi/g.

property as deep as 7 feet bgs; they may be related to former underground storage tanks (USTs). Elevated concentrations of PAHs found throughout the surficial soils at the former WACC property may be attributable to the handling of the contents of on-site USTs and/or the current use of the area to store demolished cars. A 2010 report by the New York City Department of Design and Construction identified two on-Site USTs whose contents were not reported. The same report indicates that a filling station with gasoline USTs previously operated at the property. Similar PAH concentrations were also found at nearby 308 Cooper Street.

Elevated concentrations of polychlorinated biphenyls (PCBs) were found in three surficial soil locations, with a maximum concentration of 100 milligrams per kilogram (mg/kg). PCBs in the shallow soils may be related to the USTs or a sump located below the building on Lot 33. While arsenic and iron concentrations exceeding the screening criteria were found in all samples at all depths, because these contaminants were also found at similar concentrations off-property, it is likely that they are associated with urban fill.

Soils Underlying Streets

Soil samples collected from a soil boring advanced in the middle of the intersection of Irving Avenue and Moffat Street revealed 209.93 pCi/g of Th-232 and 38.65 pCi/g of Ra-226 in the top 1 foot of soil. Contaminant concentration in soils under Moffat Street generally decreased moving south away from the WACC property, with elevated concentrations of Th-232 and Ra-226 observed in mostly surficial samples. Two soil borings located in gamma reading hotspots had elevated surficial Th-232 at 28.55 pCi/g and 59.35 pCi/g and Ra-226 at 5.55 pCi/g and 11.13 pCi/g, respectively. Visual observations of the soils at these locations indicated potential waste tailings in the top foot of soil. Approximately 40 feet south from the hotspot on Moffat Street, gamma readings drop to just above or within background levels.

Sewers and Associated Soils

The sewer investigation found significant radionuclide contamination present in the sewer system originating at the former WACC property. Gamma count measurements were significantly elevated in the manholes south of the former WACC buildings on Irving Avenue where process-liquors containing thorium were likely discharged. The elevated gamma counts (>20 times background) continue in the sewer line and manholes on Irving Avenue for approximately two blocks. Radionuclide contamination within the pipes and manholes is present in sediments and structural materials of the sewer manholes near the former WACC property.

The maximum radionuclide concentrations in sewer structural materials were found in the manhole located approximately 50 feet northwest of the intersection of Irving Avenue and Cooper Avenue, with Th-232 at 2,536.2 pCi/g and Ra-226 at 163.1 pCi/g. The maximum Th-232 concentration in sewer sediments was observed in the manhole located south of the former WACC property on Irving Avenue, with Th-232 at 1,218.1 pCi/g and Ra-226 at 45.9 pCi/g.

Irving Avenue east of the Irving Avenue/Moffat Street intersection likely contains deep contamination associated with disposal of contaminated process-liquors in the sewer line in this area that may have leaked to the surrounding soils. One soil sample collected during the RI had a Th-232 concentration of 5 pCi/g and a Ra-226 concentration of 1.15 pCi/g. Contamination down to 8 feet bgs was observed at the intersection and the northern portion of Moffat Street at a concentration of 3.31 pCi/g of Th-232 and 2.31 pCi/g of Ra-226.

The Irving Avenue/Moffat Street intersection had the highest gamma scan readings outside of the WACC property. Gamma scan levels generally dropped to four times background at the intersection of Irving Avenue and Schaeffer Street and dropped to background levels at the intersection of Irving Avenue and Eldert Street, with sporadic occurrences of gamma levels above four times background continuing in the sewer along Halsey Street to Wyckoff Avenue.

While soil borings collected adjacent to the sewer lines found only limited radionuclide contamination, a fiberscope survey identified breaks in the pipeline along Irving Avenue in the vicinity of Cooper Street. Therefore, it is likely that the bedding material below the sewer in this area is contaminated.

Elevated Th-232 concentrations were detected in sediments in Newtown Creek in the area immediately adjacent to the sewer outfall. The maximum Th-232 concentration in these sediments was 70.2 pCi/g from 5 to 6 feet bgs.

Groundwater

Four rounds of groundwater sampling were conducted as part of the RI. While Th-232 concentrations slightly exceeded the screening criterion in one groundwater sample collected during the second sampling event, subsequent sample results indicated that radionuclide concentrations in the groundwater are all below the screening criteria.

Volatile organic compounds (VOCs) exceeded the standards in on-Site groundwater. There were, however, no known VOC uses at the WACC facility, VOCs were not detected in on-Site soil samples, and an upgradient groundwater sample showed elevated VOC concentrations. Therefore, it was concluded that the on-Site VOC concentrations were due to a non-site-related upgradient source.

Gamma Exposure Rate Confirmation Surveys

Gamma exposure rate surveys confirmed the results from the previous gamma exposure rate surveys conducted within the former WACC buildings and on sidewalks and streets near the former WACC property. Exposure rates remain above background levels throughout each of these areas, but they were within the background range a few blocks from the former WACC property. The maximum gamma exposure rates observed were collected on Irving Avenue south of the former WACC property at 220 microRoentgens per hour (μR/hr) [8] near the sidewalk curb and 338 μR/hr in the middle of the street. These readings were taken at waist height or approximately three feet above the ground surface.

School/Daycare Center Investigation

Soil samples collected from around the nearby school only slightly exceeded the screening criteria. Soil samples collected from beneath the school and from around and beneath the nearby daycare center did not contain radiological contamination. Short-term radon levels collected in the daycare center and school and long-term radon and thoron levels collected in the school were below or equal to the screening criteria for indoor air, ranging from 0.1 pCi/L to 0.4 pCi/L. Gamma exposure rates collected from within the school and daycare center were all within or below the background observed for the neighborhood.

RISK SUMMARY

Based upon the results of the RI, a baseline human health risk assessment (HHRA) was conducted to estimate current and future effects of contaminants on human health. A baseline HHRA is an analysis of the potential adverse human health effects of releases of hazardous substances from a site in the absence of any actions or controls to mitigate such releases under current and future land and groundwater uses.

A four-step human health risk assessment process was used to assess Site-related excess lifetime cancer risks and noncancer health hazards. The four-step process is comprised of Hazard Identification of Chemicals of Potential Concern (COPCs) and Radionuclides of Potential Concern (ROPCs), Exposure Assessment, Toxicity Assessment, and Risk Characterization (see the text box below, "What is Risk and How is It Calculated?" for more details on the risk assessment process).

The excess lifetime cancer risk and non-cancer health hazard estimates in the HHRA are based on current reasonable maximum exposure scenarios and were developed by taking into account various health protective estimates about the frequency and duration of an individual's exposure to chemicals selected as COPCs and ROPCs, as well as the toxicity of these contaminants.

Excess lifetime cancer risks and non-cancer hazard indices (HIs) are summarized below.

The Site is in a mixed industrial/commercial area with no environmentally-sensitive areas and limited habitat for ecological receptors. Therefore, a focused screening level ecological risk assessment (SLERA) was conducted in lieu of a full SLERA to assess the risk posed to ecological receptors based on sewer discharges into Newtown Creek.

Human Health Risk Assessment

While the Site is located in a mixed industrial/commercial area, there are residences located on-Site and within a few hundred feet of the Site. The predominant land use in the area surrounding the former facility is residential (attached houses and apartment buildings), and the neighborhood is near areas of Brooklyn that have been under intense redevelopment (primarily residential) over the past 10 years.

Due to the developed nature of the Site, direct exposure to COPCs in the soil (*i.e.,* direct contact with contaminated soil, as opposed to exposure to radiation emanating from the soil, which is discussed under complete exposure pathways, below) is limited for current receptors. In addition, groundwater is not currently used for any purpose at or near the Site; therefore, direct exposure to contaminants in groundwater was not evaluated for current receptors.

While it is expected that the future land and groundwater use in this area will remain the same, a change in land use to residential was considered in the risk assessment, as is discussed in more detail below.

COPCs and ROPCs were selected primarily through comparison to risk-based screening levels. COPCs were identified for surface and subsurface soil and groundwater by comparison of maximum detected

[8] μR/hr is a measurement of energy produced by radiation in a cubic centimeter of air.

concentrations in site media to EPA regional screening levels for residential soil and tap water. Maximum detections of radionuclides in Site media were compared to EPA preliminary remediation goals for residential soil and tap water to select ROPCs.

The HHRA evaluated health effects that could result from external radiation exposure from surface and subsurface soils and outdoor and interior surfaces, direct contact (*i.e.,* ingestion and inhalation) with radionuclides and other chemicals in surface soils, subsurface soils, and sewer sediments, inhalation of radon and thoron in indoor air, direct contact with chemicals in the groundwater, and inhalation of vapors from groundwater.

Based on the current use and anticipated future use, the HHRA focused on a variety of possible receptors, including on-Site workers, public users of the property and surrounding areas, nearby and on-Site residents, construction/utility workers, trespassers, and school children.

A more detailed discussion of the exposure pathways and estimates of risk can be found in the *Final Human Health Risk Assessment.*

Human Health Risk Assessment Summary

In general, EPA recommends a target cancer risk range of 1×10^{-6} to 1×10^{-4} and a HI value of 1 as threshold values for human health impacts.

Non-radiological excess cancer risk exceeds EPA's target threshold for future residents and is at the upper end of EPA's target range for industrial workers. The primary COPC cancer risk drivers are PCB Aroclors and the PAH benzo(a)pyrene present in surface soil. Hot spots for these COPCs are present on the former WACC property. Noncancer health hazards associated with exposure to surface soil for future residents exceed the target threshold due to exposure to PCBs and selenium. Noncancer health hazards associated with exposure to surface soil for future industrial workers also exceed the target threshold due to exposure to PCBs. Excess cancer risk for future construction/utility workers exposed to COPCs in surface/subsurface soil is within EPA's target range. Noncancer health hazards associated with exposure to surface/subsurface soil for future construction/utility workers exceed the target threshold established for exposure to PCBs.

Complete exposure pathways for current, commercial receptors to radionuclides of potential concern include external gamma radiation from soil, external gamma radiation from outdoor and indoor surfaces, and inhalation of radon and thoron in indoor air.

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the COPCs at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants in air, water, soil, etc. identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential excess lifetime risk of developing cancer, additional to baseline, and the potential for non-cancer health hazards.

The likelihood of an individual developing excess cancer is expressed as a probability. For example, a 10^{-4} excess lifetime cancer risk means a "one-in-ten-thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk. For non-cancer health effects, an HI is calculated. The key concept for a non-cancer HI is that a threshold (measured as an HI of less than or equal to 1) exists below which non-cancer health hazards are not expected to occur. The goal of protection is 10^{-6} for excess cancer risk and an HI of 1 for a non-cancer health hazard. Chemicals that exceed a 10^{-4} excess cancer risk or an HI of 1 are typically those that will require remedial action at the site.

Excess cancer risks were estimated for radiological/non-radiological cancer risks, and then the radiological cancer risks were estimated for non-radon-related cancer risks and radon-related cancer risks.[9] Non-radon-related excess cancer risk for current, commercial indoor workers (1 x 10^{-3}) and industrial workers (3 x 10^{-3}) exceed EPA's target cancer risk range, primarily, related to external gamma radiation exposure from Th-232 and its associated decay products (over 90 percent), with the majority of the remaining fraction associated with Ra-226. Inhalation of dust particles and soil ingestion pathways make negligible contribution to risk. Cancer risk related to exposure to radon gas, produced by the decay of radioactive material on-Site, was estimated to be significantly higher than exposure to external gamma radiation. The excess cancer risk from radon was 2×10^{-3} for the current and future commercial indoor worker, as well as the future industrial worker (or double the Th-232 risk). The excess radiological cancer risk was estimated at 3×10^{-3} for both radon and non-radon risk for the future industrial worker.

As noted above, as part of a 2013 removal action which was intended to reduce potential radiation exposure to workers over the short term, EPA installed shielding in most of the work areas and radon mitigation systems in some areas on the former WACC property. Shielding was shown to be effective in reducing annual exposure to current workers below public dose limits.

Total radiological excess cancer risk for future on-property residents, excluding radon, is approximately 5×10^{-3}. For residential consumption of home grown produce, the risk was 1×10^{-2}. Radiological excess cancer risk was dominated by external exposure, which accounts for 80 to 90 percent of estimated risk. Th-232 and its associated decay products was responsible for most (greater than 90 percent) of the risk due to external exposure. The total radiological excess cancer risk estimate, including radon but excluding produce, is 8×10^{-3}. The total radiological excess cancer risk estimate for all exposure pathways is 2×10^{-2}.

Radiological risks for both future indoor and industrial workers are anticipated to be much the same as risks for current workers. Any future commercial or industrial construction is likely to have a substantial on-slab foundation, which should provide much the same shielding as the shielding previously put in place. Total cancer risk for future workers considering shielding from a foundation and, excluding radon, is 2×10^{-3} and 3×10^{-3} including radon. Excess cancer risks for future workers assuming no cover of the contaminated zone range as high as 4×10^{-3}. For future industrial workers with shielding and excluding radon, the cancer risk is 3×10^{-3} and including radon, it is 5×10^{-3}. With no cover, the cancer risk is 5×10^{-3}.

Future development of the Site would require construction workers to be on-Site without benefit of shielding for up 100 work days. Excess cancer risk for construction workers would be about 5×10^{-5}. For utility workers exposed to sewer sediment, excess cancer risk would be about 2×10^{-4}or at the upper end of the acceptable risk range. Future risks for the general public and for off-Site receptors are assumed to be similar to current risks for these receptors. High risk estimates (above 1×10^{-4}) for workers suggest some potential for the general public to experience exposure above regulatory thresholds.

Groundwater is not currently used as drinking water, and it is unlikely to be used as such in the foreseeable future; however, drinking water scenarios were evaluated for future residents and future commercial indoor workers. Chemical risk drivers in groundwater at the Site include tetrachloroethylene (PCE), trichloroethylene (TCE), and hexavalent chromium. PCE and TCE contaminant plumes appear to originate from upgradient sources and are not deemed to be Site-related. The risk associated with exposure to hexavalent chromium in groundwater is most likely overestimated because the HHRA assumes that hexavalent chromium is present as a fraction of the total chromium concentration.

The total HI under the reasonable maximum exposure (exposure above about the 90th percentile of the population distribution) scenario for future residents exposed to COPCs in surface soil is 55. The majority of the HI is due to ingestion of PCBs.

Screening Level Ecological Risk Assessment Summary

Due to the extremely limited habitat, a full SLERA was not conducted; instead a focused screening evaluation was conducted. The purpose of the focused SLERA was to describe the likelihood, nature, and extent of adverse effects in ecological receptors exposed to Site-related radionuclides as a result of releases to the environment from past processing activities at the Site. Because the CSO discharges may contain thorium waste from

[9] Cancer slope factors provided in the RESidual RADioactivity, Department of Energy computer model (RESRAD) Onsite Version 7.2 model and in the online EPA PRG Calculator for Radionuclides were used by EPA's contractor, CDM Smith, for radionuclides. CDM Smith also completed a risk and dose assessment using the Preliminary Remediation Goal (PRG) calculator and RESRAD 7.2. Both methods were used to estimate cancer risk from radionuclides and the results from both methods support the need to take action under CERCLA.

monazite sand processing, this evaluation focused on risks to ecological receptors exposed to the Site-related CSO discharges in Newtown Creek (approximately 1.9 miles to the northwest). Newtown Creek is a tidal arm of the New York-New Jersey Harbor Estuary.

Maximum and mean radionuclide concentrations measured in sediment were compared to biota concentration guides (BCGs) for riparian animals in the aquatic ecosystem. The results of the screening evaluation verify that radionuclide concentrations in sediment in the East Branch of Newtown Creek are significantly less than BCGs and that dose to receptors is below biota dose limits. The bulk of measured radioactivity in sediment is likely due to natural background of radionuclides except for the thorium isotopes (*i.e.,* Th-228, Th-230, and Th-232) and their progeny. Further supporting conclusions of low or insignificant risk to ecological receptors are observations that the Site and nearby areas provide only limited ecological habitat.

Risk Assessment Conclusions

The results of the HHRA indicate that radiation from surface and subsurface soils, the inhalation of radon in indoor air, and incidental ingestion of PCBs and benzo(a)pyrene in surface soil present unacceptable exposure risks. Based on the results of the RI and the risk assessment, EPA has determined that the actual or threatened releases of hazardous substances from the Site, if not addressed by the preferred alternative or one of the other active measures considered, may present a threat to human health or welfare or the environment. It is EPA's current judgment that the preferred remedial alternative identified in this Proposed Plan is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are specific goals to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered guidance, and Site-specific risk-based levels.

The following RAOs have been established for the Site:

- Reduce or eliminate human exposure via inhalation of radon and thoron, incidental ingestion, dermal adsorption, and external exposure to radiological contamination (Ra-226 and Th-232) present within the on-Site buildings to levels protective of current and anticipated future use by preventing exposure to contaminant levels above preliminary remediation goals (PRGs);[10]
- Reduce or eliminate the human exposure threat via inhalation, incidental ingestion, dermal adsorption, and external exposure to contaminated Site soils and solids (*i.e.,* sewer pipe and sediments/sludge in sewers) to levels protective of current and anticipated future land use by preventing exposure to benzo(a)pyrene, Aroclor-1260, Ra-226 and Th-232 to concentrations above PRGs; and
- Prevent/minimize the migration of Site contaminants off-Site through surface runoff, dust particulate migration, and CSO discharge.

In achieving the RAOs for the Site, EPA will also rely on "As Low As Reasonably Achievable" (ALARA) (10 CFR 20.1003). ALARA, which has been used at other radiologically-contaminated sites in EPA Region 2, means taking additional measures during implementation of the remedial action beyond those required to meet a specified cleanup goal to assure protectiveness. An ALARA approach will be used because of the long-lived nature of radionuclides, the difficulty in eliminating routes of exposure, and limitations of the analytical equipment to detect radionuclides at levels approaching natural background levels. Applying PRGs with ALARA principles at other EPA Region 2 sites has resulted in exposure levels that are lower than the levels that would result from using the PRGs alone.

Preliminary Remediation Goals

The PRGs for this Site are summarized in the table, below.

Contaminants of Concern	**Preliminary Remediation Goal**	**Specifically Applied Principles**
Solids		
PCBs	1 mg/kg	
Benzo(a)pyrene	1 mg/kg	
Ra-226[11]	1 pCi/g	ALARA
Th-232	4 pCi/g	ALARA

[10] Because there are no promulgated standards or criteria that apply to radiological-contaminated soils and building material, PRGs were developed. PRGs are used to define the extent of cleanup needed to achieve the RAOs.

[11] Ra-226 is used to indicate U-238 levels.

Contaminants of Concern	**Preliminary Remediation Goal**	**Specifically Applied Principles**
Indoor Air		
Combined Radon-222 and Radon-220 measured indoors	4 pCi/L[12]	ALARA
Combined decay products of Radon-222 and Radon-220 measured indoors	0.02 working level [12,13]	ALARA

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA 121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARs, and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to reduce permanently and significantly the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a site. CERCLA 121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA 121(d)(4), 42 U.S.C. §9621(d)(4).

Detailed descriptions of the remedial alternatives considered for addressing the contaminated building material, sewer pipe, and manholes, and surface and subsurface soil contamination can be found in the *Final Feasibility Study Report* for the Site.

The time required to construct or implement the remedy under each alternative are estimates based on construction activity production rates. Actual durations may be longer. The estimates do not include the time required to design the remedy, negotiate the performance of the remedy with any potentially responsible parties, or procure contracts for design and construction.

The remedial alternatives are:

Alternative 1: No Further Action

Capital Cost:	$0
Annual O&M Cost:	$0
Present-Worth Cost:	$0
Construction Time:	0 months

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. The no-action remedial alternative does not include any physical remedial measures that address the contamination at the property.

Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated materials.

Alternative 2: Temporary Relocation of Tenants, Targeted Building Demolition, Installation of Additional Shielding, Shallow Soil Excavation, Soil Cover Over Remaining Contamination, Sewer Removal/Cleaning, Off-Site Disposal, and Institutional Controls

Capital Cost:	$34,400,000
Annual O&M Cost:	$109,000
Present-Worth Cost:	$36,200,000
Construction Time:	1 year 3 months

Under this alternative, the five tenants of the buildings on Lots 42, 44, and 46 would be temporarily relocated while on-Site construction occurs. The construction would begin with the demolition of the currently unoccupied warehouse located on Lot 33.

After the building demolition is completed, contaminated soil would be excavated to a maximum depth of approximately 4 feet bgs on the portions of the Site where no buildings are present and beneath the roadway and sidewalks along Irving Avenue and Moffat Street and on the 308 Cooper Street and 350 Moffat Street properties.

In accordance with ALARA principles, the clay pipe sewer line beginning at the manhole located on Irving Avenue southwest of the former WACC property and extending northwest to the manhole located approximately 50 feet northwest of the intersection of Irving Avenue and Cooper Avenue would be excavated and replaced (approximately

[12] Including natural background.
[13] Some devices measure radiation from radon decay products, rather than radiation coming directly from radon. Measurements from these devices are often expressed as “Working Level.”

150 feet of pipe). After the removal of the sewer line, bedding material samples would be collected from the open excavation to determine if the bedding material is contaminated. Any bedding material that exceeds the PRGs would also be removed and replaced.

The remaining portion of the sewer line down to the intersection of Wyckoff Avenue and Halsey Street (approximately 1,950 feet) and a portion of the pipe line on Cooper Avenue branching with the Irving Avenue sewer line approximately 200 feet northeast of the Cooper Avenue and Irving Avenue intersections (approximately 200 feet) would undergo jet cleaning using high-pressure water nozzles to flush out dirt, sediments/sludge, and any other matter from the sewer pipeline. The jetting would be performed in combination with vacuuming to collect the jetted waste for off-Site disposal. Following completion of sewer jet cleaning, a gamma survey would be performed within the flushed sewer to determine if high gamma counts are still present. Any portions of the sewer line with elevated gamma counts would undergo further investigation, including the sewer material and bedding, to determine the source of the radiological contamination. Those portions of the sewer line, along with any bedding material that exceeds PRGs, would be removed and replaced.

In order to maintain uninterrupted sewer service during the sewer line replacement, upgradient sewage flow would need to temporarily bypass the portion of sewer line under construction to the downgradient sewer line. To do this, a temporary bypass system with the design flow capacity of the upgradient sewer line would be installed in the upgradient manhole to the downgradient manhole. Temporary plugs would be set in place between these points to allow the sewer pipe to be removed.

Final status surveys (gamma scan and post-excavation sampling) would be performed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)[14] to ensure that the PRGs are met prior to Site restoration. In areas where contaminated soil is determined to be present greater than 4 feet bgs, the excavation would only be increased horizontally based on sidewall sampling results in excess of PRGs. The Site restoration would include backfill of excavated areas with clean fill, placement of a geofabric layer to delineate clean fill from contaminated soil, and replacement of portions of the sidewalk and roadway that were removed during excavation.

Additional radiation shielding would be installed on top of the existing shielding in the buildings on Lots 42 and 44 and the basement side wall on Lot 46 along its boundary with Lot 44.

Under this alternative, it is estimated that approximately 18,800 cubic yards (cy) of contaminated soil, sewer sediment, and debris would be excavated and disposed of off-Site. The materials would be disposed of as Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM)[15] waste in a permitted landfill. It is estimated that approximately 5,900 cy of building debris would be disposed of off-Site in a non-hazardous waste landfill.

An environmental easement would be recorded for Lots 42, 44, 46, and Irving Avenue and Moffat Street, and the 350 Moffat Street property, which would limit intrusive activity and allow access for monitoring. The easement would also require the installation of a radon mitigation system for future construction.

A long-term monitoring plan would be put in place to monitor radon and thoron levels in the buildings that would remain at the former WACC property. Maintenance of the existing radon system would continue, annual inspections of the soil cover would be performed to monitor erosion and ensure continued protection of human health, and maintenance would be conducted as necessary, and groundwater samples would be collected periodically to monitor if contaminants are leaching from the soil over time.

While a remediation time frame of 30 years is used for estimating the costs associated with the operation and maintenance (O&M) activities, due to the extremely long half-life of the radioactive isotopes present at the Site, it is understood that under this alternative, O&M would continue in perpetuity.

Annual inspections of the soil cover would be performed to monitor erosion and ensure continued protection of human health and maintenance would be conducted as necessary. Groundwater samples would be collected periodically to monitor if contaminants are leaching from the soil over time.

Although not part of the alternative, because this alternative would result in contaminants remaining on-Site above levels that allow for unrestricted use and

[14] This document provides guidance on how to demonstrate that a site is in compliance with a radiation dose- or risk-based regulation.

[15] Naturally-occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities, such as manufacturing, mineral extraction, or water processing.

unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years.

Alternative 3: Permanent Relocation of Tenants, Demolition of WACC Buildings, Shallow Soil Excavation, Soil Cover of Remaining Contamination, Sewer Removal/Cleaning, Off-Site Disposal, and Institutional Controls

Capital Cost:	$33,500,000
Annual O&M Cost:	$60,000
Present-Worth Cost:	$34,200,000
Construction Time:	1 year 4 months

Under this alternative, the five tenants of the buildings on Lots 42, 44, 46, and 48 would be permanently relocated. Subsequently, all of the on-Site buildings would be demolished.

Following the demolition of the buildings, soil excavation would extend to a maximum depth of approximately 4 feet bgs over the entire former WACC property,[16] as well as beneath the roadway and sidewalks along Irving Avenue and Moffat Street and on the 308 Cooper Street and 350 Moffat Street properties.

The contaminated sewer would be addressed as described in Alternative 2.

Final status survey and Site restoration would be addressed as described in Alternative 2.

Under this alternative, an estimated 19,400 cy of contaminated soil, sewer sediment, and debris would be excavated and disposed of off-Site as TENORM waste in a permitted landfill. Approximately, 6,400 cy of building debris would be disposed of off-Site in a non-hazardous waste landfill.

To limit intrusive activity and allow access for monitoring, an environmental easement would be recorded for the portions of the former WACC property and Irving Avenue and Moffat Street, and the 350 Moffat Street property where contamination would remain at depth. The easement would also require the installation of a radon mitigation system for future construction.

Annual inspections of the soil cover would be performed to monitor erosion and ensure continued protection of human health and maintenance would be conducted as necessary. Groundwater samples would be collected periodically to monitor if contaminants are leaching from the soil over time.

Although not part of the alternative, because this alternative would result in contaminants remaining on-Site above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years.

Alternative 4: Permanent Relocation of Tenants, Demolition of WACC Buildings, Soil Excavation, Sewer Removal/Cleaning, and Off-Site Disposal

Capital Cost:	$39,400,000
Annual O&M Cost:	$0
Present-Worth Cost:	$39,400,000
Construction Time:	1 year 5 months

Under this remedial alternative, as in Alternative 3, the five tenants of the buildings on Lots 42, 44, 46, and 48 would be permanently relocated, and all of the on-Site buildings would be subsequently demolished.

Following the demolition of the buildings, all soils exceeding the PRGs would be excavated from the former WACC property, including those highly contaminated soils that extend down to approximately 28 feet bgs beneath Lots 42 and 44, as well as those beneath the roadway and sidewalks along Irving Avenue and Moffat Street and on the 308 Cooper Street and 350 Moffat Street properties.

The contaminated sewer line would be addressed as described in Alternative 2.

Final status surveys would be performed to ensure that PRGs are met prior to Site restoration in accordance with MARSSIM.

Site restoration would include backfilling areas of the excavated areas with clean fill followed by resurfacing of roadways and sidewalks impacted by the construction. The top layer of the clean fill would consist of soil suitable to support vegetation.

Under this alternative, an estimated 24,300 cy of contaminated soil, sewer sediment, and debris would be excavated and disposed of off-Site as TENORM waste in a permitted landfill. Approximately 6,400 cy of building

[16] Contaminated soil beneath Lots 42 and 44 extends to a depth of approximately 28 feet bgs. Risk calculations indicate that if a building is constructed at the property in the future, the four-foot clean soil cover and installation of a radon mitigation system would reduce the risk to within EPA's acceptable risk range.

debris would be disposed of in a non-hazardous waste landfill.

Because this alternative would not result in contaminants remaining on-Site above levels that allow for unrestricted use and unlimited exposure, five-year reviews would not be necessary.

EVALUATION OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria set forth in federal regulation, namely, overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, state acceptance, and community acceptance.

The evaluation criteria are described below.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provide grounds for invoking a waiver.
- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.
- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies, with respect to these parameters, a remedy may employ.
- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.
- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
- Cost includes estimated capital and O&M costs, and net present-worth costs.
- State acceptance indicates if, based on its review of the RI/FS and this Proposed Plan, the state concurs with the preferred remedy at the present time.
- Community acceptance will be assessed in the ROD and refers to the public's general response to the alternatives described in this Proposed Plan and the RI/FS reports.

A comparative analysis of these alternatives based upon the evaluation criteria noted above follows.

Overall Protection of Human Health and the Environment

Alternative 1 would not be protective of human health and the environment, since it would not actively address the contaminated soil, building materials, and sewer line.

Alternative 2 would achieve the RAOs and protection of human health through the installation of additional shielding, excavation and off-Site disposal of contaminated surface soil and backfill with clean fill, and sewer removal/cleaning, in combination with the installation of a radon mitigation system for future construction, long-term management, and institutional controls. The protectiveness of this alternative would be dependent on the adherence to institutional controls and the O&M of the implemented remedy.

Alternative 3 would achieve RAOs and protection to human health by excavation and off-Site disposal of contaminated surface soil and backfill with clean fill, sewer removal/cleaning, long-term management, installation of a radon mitigation system for future construction, and institutional controls. The protectiveness of this alternative is dependent on adherence to institutional controls and O&M of the implemented remedy.

Alternative 4 would achieve RAOs and protection of human health and the environment by sewer removal/cleaning and excavating contaminated soil and building materials above the PRGs from the Site. The residual risks would be within EPA's acceptable risk range and, therefore, institutional controls would not be required.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Because there are no federal or state promulgated standards or criteria that apply to radiological-contaminated soils and building material, PRGs were developed to define the extent of the cleanup needed to achieve the RAOs.

Because the contaminated soils, building material, and sewer would not be addressed under Alternative 1, this alternative would not achieve the cleanup objectives.

Alternative 2 would meet the PRGs through the installation of additional shielding, the excavation and off-Site disposal of contaminated surface soil and backfill with clean fill, sewer removal/cleaning, and the use of radon mitigation systems in future construction.

Alternative 3 would meet the PRGs through a combination of excavation and off-Site disposal of contaminated surface soil and backfill with clean fill, and sewer removal/cleaning.

Alternative 4 would meet the PRGs through sewer removal/cleaning and removing contaminated soil and building materials.

Long-Term Effectiveness and Permanence

Alternative 1 would involve no active remedial measures and, therefore, would not be effective in eliminating the potential exposure to contaminants.

The additional shielding, excavation and off-Site disposal of contaminated surface soil and backfilling with clean fill, and sewer removal/cleaning under Alternative 2 would provide long-term effectiveness and permanence for the buildings that would remain in place. Long-term effectiveness and permanence would rely on the maintenance of the soil covering the contamination left in place, future monitoring, and implementation of institutional controls to require the use of radon mitigation systems if buildings are constructed on the former WACC property in the future.

Alternative 3 would provide a slightly greater degree of long-term effectiveness and permanence than Alternative 2 in that it would leave no WACC buildings in place and would employ shallow excavation and backfill with clean fill in the excavation areas; however, it would still require institutional controls to limit intrusive activity and allow access for monitoring.

Due to the extremely long half-life of the radioactive isotopes present at the Site, under Alternatives 2 and 3, O&M would be necessary in perpetuity.

Alternative 4 would provide the highest degree of long-term protectiveness and permanence by sewer removal/cleaning and removing contaminated soil and building materials above the PRGs from the Site.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 would provide no reduction in toxicity, mobility or volume.

Alternatives 2, 3 and 4 would reduce the mobility of contaminants to varying extents by removing varying amounts of contaminated soil and debris from the Site. As Alternative 4 would remove the greatest amount of contaminated soil and debris, it would result in the greatest reduction in the mobility of contaminants, followed by Alternative 3 and the Alternative 2.

Alternatives 2 through 4 would not reduce the toxicity or volume of contaminants and would not meet the statutory preference for treatment as a principal element of the remedial action. However, no proven and cost-effective treatment technology is currently available to treat radioactive wastes.

Short-Term Effectiveness

Alternative 1 does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to remediation workers or the community as a result of its implementation.

Alternatives 2-4 involve the same extent of sewer removal and cleaning, and would, therefore, similarly adversely impact local traffic through street closures.

Under Alternative 2, only the warehouse on Lot 33 would be demolished and would only involve shallow soil excavation; therefore, of the action alternatives, this alternative would present the least impact to the community and workers due to the demolition and excavation work.

Alternative 3 would present a slightly greater impact to the community and workers than Alternative 2 due to demolition of all of the buildings and the excavation of a greater volume of soil.

Because Alternative 4 would involve the greatest amount of soil excavation, it would cause the greatest level of short-term impacts to the community and potential impact to workers due to the need to safely manage and conduct these operations in limited space and constrained areas. These impacts could, however, be mitigated as discussed below.

For Alternatives 2-4, there is a potential for increased stormwater runoff and erosion during construction and excavation activities that would have to be properly managed to prevent or minimize any adverse impacts.

For these alternatives, appropriate measures would have to be taken during the building demolition and excavation activities to prevent the transport of fugitive dust and exposure of workers and the community.

Alternatives 2-4 might present some limited risk to remediation workers through exposure to radiologically-contaminated materials through the building demolition and soil excavation activities. The risks to on-Site workers could, however, be minimized by utilizing proper protective equipment.

Noise from the demolition and excavation work associated with Alternatives 2-4 could present some limited adverse impacts to remediation workers and nearby residents. Following appropriate health and safety protocols and exercising sound engineering practices would protect the remediation workers and community.

Alternatives 2-4 would require the off-Site transport of contaminated soil and material (ranging from approximately 920 truckloads for Alternative 2 to 1,240 truckloads for Alternative 4), which would potentially adversely affect local traffic. However, a traffic control plan would be developed to mitigate adverse impacts to traffic.

The temporary relocation of the five tenants under Alternative 2 would physically disrupt the businesses twice. Permanently relocating the businesses under Alternatives 3 and 4 would, on the other hand, cause less physical disruption in that the tenants would only have to move once. Depending upon the location to which the tenants are relocated, both temporary and permanent relocation could cause the loss of customers.

Because no actions would be performed under Alternative 1, there would be no implementation time. It is estimated that Alternatives 2-4 would require one year five months, one year six months, and one year seven months, respectively, to implement.

Implementability

Alternative 1 would be the easiest alternative to implement, as there are no activities to undertake.

Although the total volume of material to be excavated under Alternative 2 is less than the other alternatives, the targeted demolition and excavation of Lot 33, coupled with the placement of shielding in the other former WACC property buildings, would likely make Alternative 2 more difficult to implement. This is due to the structural condition of the buildings on the lots adjacent to Lot 33 and the physical constraints present in the area. The demolition of all of the former WACC buildings that would occur under Alternatives 3 and 4 would make the demolition and excavation components of those alternatives easier to implement than the demolition component of Alternative 2. Given the volume of contaminated soil to be excavated, the excavation component of Alternative 4 would likely be more difficult to implement than the excavation components of Alternatives 2 and 3.

Alternatives 2-4 would employ technologies known to be reliable and that can be readily implemented. Equipment, services, and materials needed for these alternatives are readily available, and the actions would be administratively feasible. Sufficient facilities are available for the disposal of the excavated soils and demolition debris.

While the installation of additional shielding under Alternative 2 is technically feasible, the additional shielding would limit the ability of one of the tenants, an auto body shop, from conducting business, as there would not be sufficient space to lift automobiles for repairs.

The implementation of institutional controls under Alternatives 2 and 3 would be relatively easy to implement.

Cost

The estimated capital, O&M, and present-worth cost are discussed in detail in EPA's *Final Feasibility Study Report*. For estimating costs and for planning purposes, a 30-year time frame was used for O&M under Alternatives 2, 3, and 4. The costs estimates are based on the best available information. The highest present-worth cost is Alternative 4 at $38.8 million. The table below summarizes the estimated costs.

Alternative	Capital Cost	Annual O&M Cost	Present Worth
1	$0	$0	$0
2	$34,400,000	$109,000	$36,200,000
3	$33,500,000	$60,000	$34,200,000
4	$39,400,000	$0	$39,400,000

State/Support Agency Acceptance

NYSDEC concurs with the preferred remedial alternative.

Community Acceptance

Community acceptance of the preferred remedial alternative will be evaluated after the public comment period ends and will be described in the ROD.

PREFERRED REMEDY

Based upon an evaluation of the various alternatives, EPA, in consultation with NYSDEC and the other federal, state, and local governmental stakeholders, recommends Alternative 4, permanent relocation of the tenants, demolition of the former WACC buildings, contaminated soil excavation, contaminated sewer removal/cleaning, and off-Site disposal of the contaminated soils and debris, as its preferred remedy for the Site.

Under this alternative, the five tenants of the buildings on Lots 42, 44, and 46 would be permanently relocated. Subsequently, all of the on-Site buildings would be demolished.

Following the demolition of the buildings, all soils exceeding the PRGs on the former WACC property, including those highly contaminated soil that extend down to approximately 28 feet bgs beneath Lots 42 and 44, as well as beneath the roadway and sidewalks along Irving Avenue and Moffat Street and 308 Cooper Street and 350 Moffat Street properties, would be excavated.

The clay pipe sewer line beginning at the manhole located on Irving Avenue southwest of the former WACC property and extending northwest to the manhole located approximately 50 feet northwest of the intersection of Irving Avenue and Cooper Avenue would be excavated and replaced (approximately 120 feet of pipe). After the removal of the sewer line, bedding material samples would be collected from the open excavation to determine if the bedding material is contaminated. Any bedding material that exceeds the PRGs would also be removed and replaced.

The remaining portion of the sewer line down to the intersection of Wyckoff Avenue and Halsey Street (approximately 2,150 feet) would undergo jet cleaning using high-pressure water nozzles to flush out dirt, sediments/sludge, and any other matter from the sewer pipeline. The jetting would be performed in combination with vacuuming to collect the jetted waste for off-Site disposal. Following completion of sewer jet cleaning, a gamma survey would be performed within the flushed sewer to determine if high gamma counts are still present. Any portions of the sewer line with elevated gamma counts would undergo further investigation, including the sewer material and bedding, to determine the source of the radiological contamination. Those portions of the sewer line, along with any bedding material that exceeds PRGs would be removed and replaced.

In order to maintain uninterrupted sewer service during the sewer line replacement, upgradient sewage flow would need to temporarily bypass the portion of sewer line under construction to the downgradient sewer line. To do this, a temporary bypass system capable of the design flow capacity of the upgradient sewer line would be installed in the upgradient manhole to the downgradient manhole. Temporary plugs would be set in place between these points to allow the sewer pipe to be removed.

Final status surveys would be performed to ensure that PRGs are met prior to Site restoration in accordance with MARSSIM.

Site restoration would include backfilling the areas of excavation with clean fill followed by resurfacing of roadways and sidewalks impacted by the construction.

The excavated contaminated soil, sewer sediment, and debris would be disposed of either in a non-hazardous waste landfill or in a landfill permitted to accept radioactive waste, based upon the level of radioactivity in the materials.

Because this alternative would not result in contaminants remaining on-Site above levels that allow for unrestricted use and unlimited exposure, five-year reviews would not be necessary. If, however, due to the substantial cost of the alternative there is a need to incrementally fund the project, resulting in the remediation effort requiring five or more years to complete, policy five-year reviews would be required until the remedial action is completed.

During the RI, several nearby properties were reviewed to assess potential impacts from WACC operations. To accomplish this, the age of nearby buildings was compared to the time WACC conducted rare earth element extraction at the property (*i.e.,* approximately 1920 until 1954). If a building structure was present prior to 1924 and remained on the property until at least 1954, it was unlikely to have been impacted. However, if a building was constructed after WACC's processing began, the property could have been impacted. No data were collected at three properties-282 Moffat Street; 323 Moffat Street; and the parking lot of 335 Moffat Street. Additionally, only minimal data was collected at 335 Moffat Street and 338-350 Moffat Street. During the design of the selected remedy, an investigation would be conducted at the noted areas. Any contaminated soils in these areas would be addressed as part of the remedy.

Basis for the Remedy Preference

While Alternative 2 is approximately $3 million less costly than Alternative 4, the most-costly alternative, it requires the disruption of the five tenants twice (temporary relocation) and leaves significant levels of radiological contamination in-place in both the structures and underlying soil (which would also continue to produce radon/thoron gas) that would necessitate institutional controls, maintenance, and long-term monitoring to be protective. Furthermore, the additional shielding required by Alternative 2 would limit the ability of one of the tenants, an auto body shop, from conducting business, as there would not be sufficient space to lift automobiles for repairs. In addition, the ability to ensure that the institutional controls remain in place in such a setting as the WACC buildings would be difficult.

While Alternative 3 is the least costly action alternative and removes the radiologically-contaminated building materials and much of the contaminated soils, because some contaminated soil would remain, institutional controls would be necessary to restrict the future use of the property; ensuring such controls remain effectively in place can be difficult. Since the radioactive half-life of Th-232 is 14 billion years, institutional controls, maintenance, and long-term monitoring would need to be managed in perpetuity. Alternative 4 avoids the problems associated with such issues, because it permanently relocates the tenants and removes the radiologically-contaminated building materials and underlying contaminated soils, thereby allowing unlimited future use of the property.

The preferred remedy is believed to provide the greatest protection of human health and the environment, provide the greatest long-term effectiveness, be able to achieve the ARARs more quickly, or as quickly, as the other alternatives, and is cost effective. Therefore, the preferred remedy will provide the best balance of tradeoffs among alternatives with respect to the evaluating criteria. EPA believes that the preferred remedy will be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The preferred remedy will not meet the statutory preference for the use of treatment as a principal element of the remedial action because no proven and cost-effective treatment technology is currently available to treat radioactive wastes.

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The environmental benefits of the preferred remedy may be enhanced by consideration, during the design, of technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Energy Policy and NYSDEC's Green Remediation Policy.[17] This will include consideration of green remediation technologies and practices.

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[17] See http://epa.gov/region2/superfund/green_remediation and http://www.dec.ny.gov/docs/remediation_hudson_pdf/der31.pdf.

Figure 1—Wolff-Alport Chemical Corporation Site

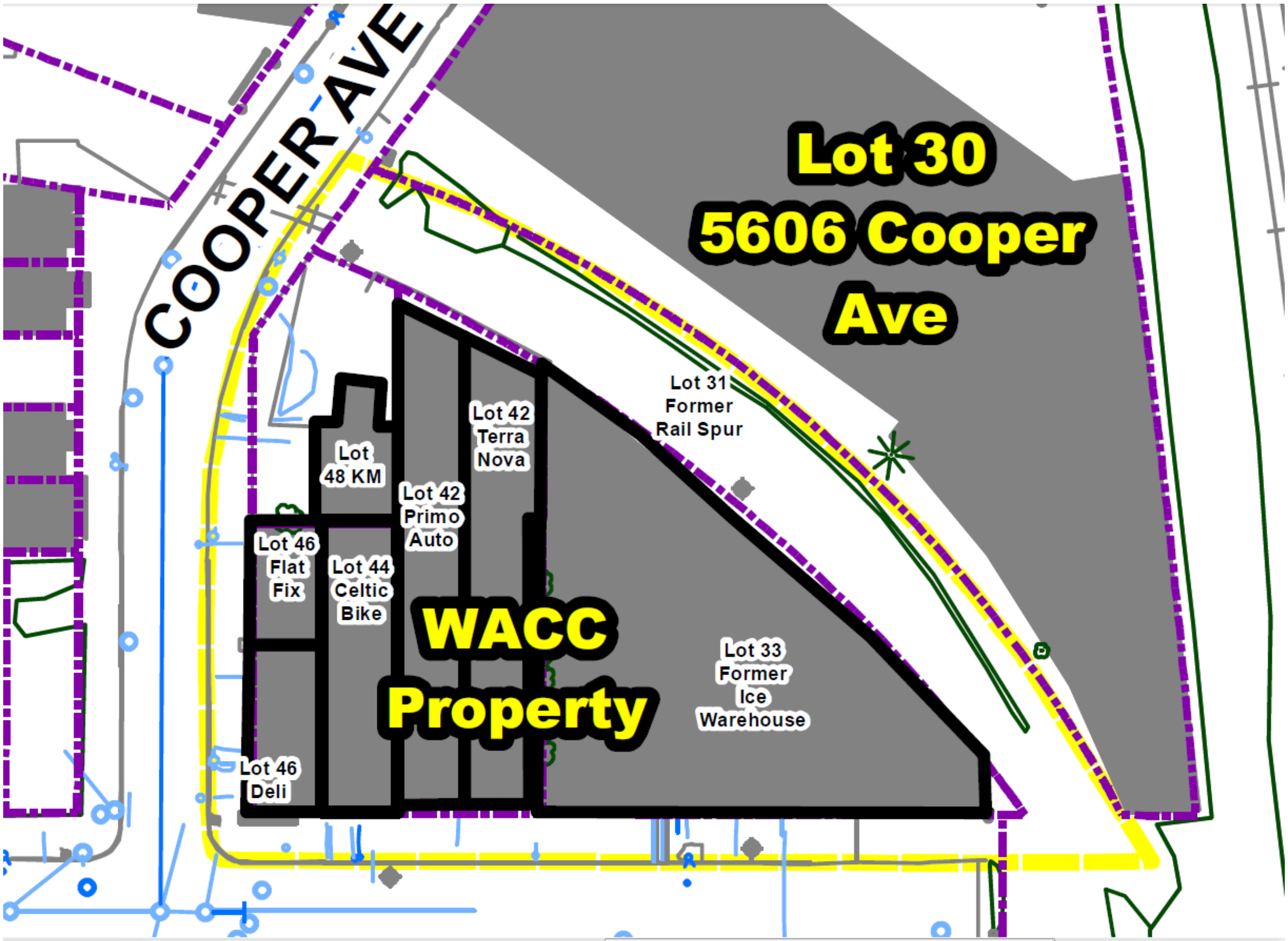
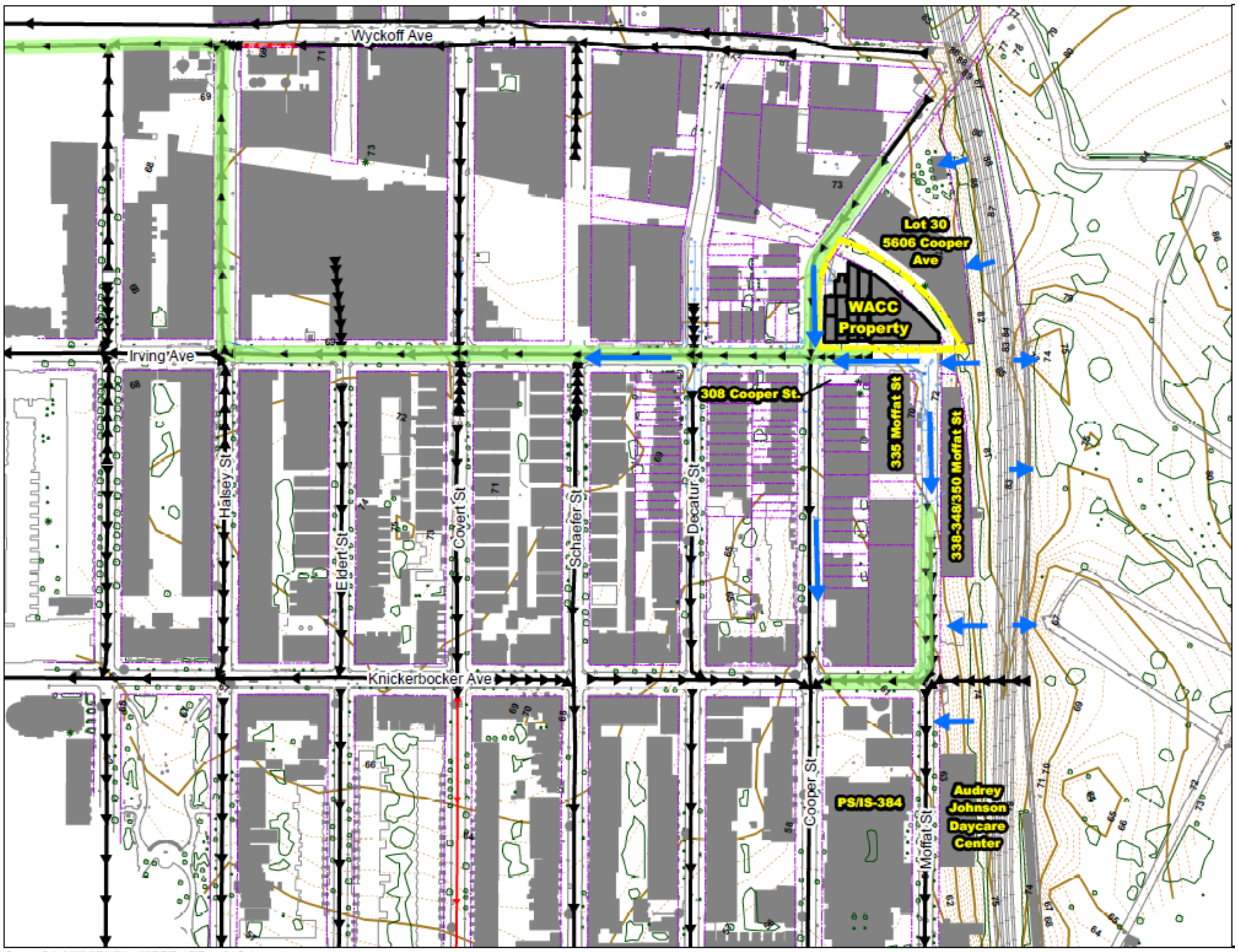


Figure 2—Wolff-Alport Chemical Corporation Site and General Area



WACC Property

Combined Storm Sewer (approx.) Shaded green in sewers flowing away from the WACC property.

Unknown Sewer (approx.)

WACC Lot Boundaries

Buildings

Vegetation

Property Lines

Topography Index Contour (5-ft)

Topography Contour (1-ft)

Surface Water Flow

Acronyms

PS/IS - Public School/ Intermediate School
WACC - Wolff-Alport Chemical Company