FINAL CLOSE-OUT REPORT
W.R. Grace and Co./Wayne Interim Storage Site
TOWNSHIP OF WAYNE, PASSAIC COUNTY, NEW JERSEY

April 2012

Prepared for:
U.S. Environmental Protection Agency, Region 2

Prepared by:
U.S. Army Corps of Engineers
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I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has determined that in accordance with *Close-Out Procedures for National Priorities List Sites* (OSWER Directive 9320.2-22, May 2011), all appropriate response actions at the W.R. Grace and Co./Wayne Interim Storage Site (the Site) have been successfully implemented. The Department of Energy (DOE) and the U.S. Army Corps of Engineers (USACE) have completed all construction activities at the Site and Vicinity Properties (VPs) associated with the Site. The remedy was completed in accordance with the approved *WISS Remedial Design/Implementation Plan* and specifications (USACE 2001a), and the *WISS Contractor Quality Control Plan* (USACE 2001b). Work at the Site and the VPs were conducted under the *Record of Decision for the Wayne Interim Storage Site* (USACE 2000) and *Explanation of Significant Differences* (USACE 2003b). The EPA conducted a final inspection on September 14, 2011, to confirm that the inaccessible soils were addressed. All monitoring has been completed in accordance with the remedy and no additional five-year reviews are anticipated.

II. SUMMARY OF SITE CONDITIONS

SITE LOCATION

The Site is approximately 6.5 acres located at 868 Black Oak Ridge Road at the intersection with Pompton Plains Cross Road in Wayne Township, Passaic County, New Jersey. The VPs are commercial and residential areas, and a Township Park, all located within one-half mile to the west and west-southwest of the Site along Sheffield Brook, which flows downstream to the Pompton River. The Site is in a highly developed area of northern New Jersey, approximately 20 miles north-northwest of Newark, New Jersey and approximately 36 miles northwest of New York City, New York as shown on Figure 1.

BACKGROUND

From 1948 through 1957, Rare Earths, Inc. processed monazite sand at the Site to extract thorium and rare earth metals. The Davison Chemical Division of W.R. Grace acquired the Site in 1957 and processing activities continued until July 1971. After

processing ceased in 1971, the facility was licensed by the Atomic Energy Commission (AEC) for storage only. In 1974, W.R. Grace partially decontaminated the Site. Some buildings were razed and the rubble and processing equipment were buried on the property.

In 1974, the Nuclear Regulatory Commission (NRC) assumed licensing responsibilities formerly held by the AEC. In 1975, the storage license for radioactive materials was terminated by the NRC following Site decommissioning and the Site was released without radiological restriction; the only stipulation was that the property deed state that radioactive materials were buried on the property.

In 1981, as part of the review of formerly licensed facilities, the NRC measured direct radiation levels and radionuclide concentrations in soil on the Site. Elevated survey measurements were noted, indicating the Site was contaminated with radium (Ra)-226, thorium (Th)-232, and uranium (U)-238, and associated daughter products. The chemical contaminants of concern (COC) are antimony, arsenic, chromium, lead, mercury, molybdenum, and thallium.

In July 1983, the DOE was authorized by the Energy and Water Development Appropriations Act of 1984 to conduct a decontamination research and development project at the Site. From 1984 to October 1997, DOE managed the Site under the Formerly Utilized Sites Remedial Action Program (FUSRAP). In September 1984, the EPA placed the Site on the National Priorities List. In September 1985, ownership of the Site transferred from W.R. Grace & Co. to the U.S. Government.

In July 1990, DOE signed a Federal Facility Agreement (FFA) that established cleanup responsibilities under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The FFA was signed by the EPA in September 1990.

In October 1997, Congress transferred administration and execution of the FUSRAP program from DOE to the USACE in the Energy and Water Development Appropriations Act of 1998. In March 1998, the original DOE/EPA Site FFA was renegotiated between EPA and the USACE.

CONSTRUCTION ACTIVITIES

REMOVAL ACTIONS

Between 1985 and 1987, DOE conducted removal actions to remove contaminated material from some of the off-site VP locations in the vicinity of the Site. The adjacent VPs had received contaminants during historical W.R. Grace processing operations, which required remediation. Excavated soils and debris were stored at the Site where the historic thorium processing operations occurred because no disposal facilities were available which were licensed or permitted to accept radiological wastes at the time. These actions were outlined in the *Action Description Memorandum, Proposed FY 1984 Remedial Actions at Wayne, New Jersey* (Argonne 1984).

During 1993, removal actions at the remaining Site VPs were conducted under the *Engineering Evaluation/Cost Analysis (EE/CA) for the Proposed Removal of Contaminated Materials from Vicinity Properties at the Wayne Site* (DOE 1993). The majority of the waste from the 1993 cleanup actions was shipped directly to a commercial disposal facility. A small amount of contaminated soil from the 1993 cleanup actions was added to the interim storage pile at the Site due to off-site waste disposal constraints in effect at the time.

For the VPs surrounding the Site, the DOE implemented residual contamination guidelines governing the release of formerly contaminated property for unrestricted use. The *DOE Guidelines for Residual Radioactivity at FUSRAP and Remote SPMP Sites (DOE 1985)*, provided the following guidelines:

- External gamma radiation levels on a site released for unrestricted use to not exceed 20 microRems/hour above the ground surface;
- Maximum permissible concentration of Ra-226 and Th-232 in soil above background levels averaged over 100 cubic meters; 5 picoCuries/gram (pCi/g) averaged over the first 15 centimeters (cm) of soil at the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface (i.e., for sub-surface soils at depths greater than 15 cm); and,
- Maximum permissible concentration of U-238 in soil; 150 pCi/g above background.

The guidelines were derived using conservative assumptions protective of human health and the environment. The DOE applied

the surface and subsurface soil criteria when evaluating the effectiveness of the removal actions. The DOE implemented the guidelines on the basis of compatibility with the criteria used for the same purpose by the EPA. No further removal was conducted when sampling data demonstrated that the residual contamination guidelines for soil were met for that property.

The DOE revised the guidelines in the early 1990's by the application of the As Low As Reasonably Achievable (ALARA) principle. In applying the principle of reducing exposure to levels ALARA, the DOE established cleanup goals for properties of 5 pCi/g, regardless of depth of contamination. These guidelines applied to Th-232 and Ra-226 concentrations; however, they were not applicable to naturally occurring background radioactivity in soils near the Site.

In 1997, when disposal facilities which were licensed or permitted to accept radiological wastes came online, the approximately 38,500-cubic yard interim storage pile was removed by DOE and shipped off-site for disposal.

Approximately 41,500 cubic yards of buried contaminated materials within the footprint of the former interim storage pile were removed and shipped off-site for disposal by the USACE under a separate CERCLA removal action that began in 1998. This action is documented in the *Engineering Evaluation/Cost Analysis for the Removal of Subsurface Materials at the Wayne Site* (USACE 1998).

REMEDIAL ACTIONS (THE SITE)

In February and March 1998, a Subsurface Characterization Study was conducted by USACE. The characterization defined the nature and extent of the remaining radiological and chemical contamination in the subsurface soils at the Site. The Remedial Investigation/Feasibility Study and Proposed Plan for the Site were released by the USACE to the public in June 1999.

In May 2000, the EPA and USACE issued a Record of Decision (ROD) identifying the selected remedy to address the remaining radioactive waste, chemical waste, operations building demolition, and groundwater at the Site. The major components of the selected remedy and remedial actions performed at the Site are summarized below:

- Excavation and disposal of the remaining contaminated subsurface materials to an average concentration of 5 pCi/g of Ra-226 and Th-232 combined, above naturally occurring background concentrations at the Site, and an average concentration of 100 pCi/g of total uranium above naturally occurring background, as determined by surveys consistent with the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (EPA 2000).
- Excavation and disposal of chemically contaminated soils above levels calculated to be protective of groundwater or above levels protective for unrestricted uses of the property (with regard to chemicals of concern) as specified in the ROD.
- Decontamination and demolition of the site operations building on the Site, removal and off-site disposal of demolition debris, and removal and off-site disposal of contaminated materials under this building.
- Removal and treatment of groundwater encountered during excavation to meet the pretreatment discharge standards of the receiving Publicly Owned Treatment Works prior to release.
- Implementation of a five-year groundwater monitoring program to establish groundwater quality after contaminated soil has been removed.
- Maintenance of the integrity of the subsurface clay layer that acts as a hydraulic barrier protecting the lower aquifer at the Site.
- Site restoration activities that will allow for beneficial unrestricted use in the future.

Remedial action objectives (RAOs) were developed to address the contaminated soil and debris at the Site, while considering the long-term goals of protecting human health and the environment, and meeting applicable or relevant and appropriate requirements (ARARs). The RAOs specified in the ROD are summarized in the table below.

Environmental Media	Remedial Action Objectives
Source Media (soil, process residues, and bulk waste), and groundwater	-To eliminate or minimize the potential for humans to ingest, come into dermal contact with, or inhale particulates of radioactive constituents, or to be exposed to external gamma radiation to achieve the level of protection required by the National Oil and Hazardous Substances Pollution Contingency Plan (10^{-4} to 10^{-6} risk range) and meet the substantive requirements of 10 CFR 20, Subpart E. -To reduce chemical COC levels in impacted media to levels that would be protective based on site-specific risk and groundwater impact evaluations. -To return impacted groundwater to conditions consistent with groundwater ARARs. -To protect the integrity of the clay layer in order to ensure protection of the lower groundwater aquifer. -To reduce potential exposure to radium and thorium in soil to levels that would be protective for the intended land use as established by site-specific risk analysis. -To reduce exposure to uranium to levels that would be protective for the intended land use. -To eliminate or minimize toxicity, mobility, and/or volume of impacted soils. -To eliminate or minimize the potential migration of contaminants into stream and storm drain sediments by surface water runoff, or by infiltration or percolation that would result in contamination of the groundwater. -To comply with chemical and action-specific ARARs.
Buildings/Structures	-To prevent exposures from radioactivity in buildings and structures greater than the guideline limits. -To access and address the contaminated soils beneath the building. -To eliminate or minimize potential exposure to external gamma radiation. -To eliminate or minimize toxicity or mobility, and/or volume of contaminants. -To comply with chemical and action-specific ARARs.

Under the May 2000 ROD, an additional 55,410 cubic yards of contaminated material and building debris were excavated and disposed of at an off-site licensed disposal facility.

The elements of the remedial construction activities and construction quality assurance (QA) and quality control (QC) are detailed in the *Post Remedial Action Report Wayne Interim Storage Site (PRAR)* (USACE 2004). The USACE managed and supervised all construction activities to ensure compliance with the remedial design, work plans, and construction specifications. The EPA provided oversight of the cleanup actions.

REMEDIAL ACTIONS (VICINTY PROPERTIES)

Following the remedial actions at the Site, USACE reviewed the cleanup actions previously taken by the DOE at the VPs. The review consisted of comparing DOE radiological screening and sampling data from the VPs and the unrestricted use criteria applied by the DOE to the cleanup values established in the ROD, and as appropriate, the State of New Jersey Administrative Code.

A Technical Memorandum documented the evaluation of the VPs and specifically identified and listed each property previously remediated by DOE. On the basis of this paper review, USACE conducted additional subsurface soil sampling at four VPs in May and June 2003. Following the review and sampling, USACE determined that prior DOE actions were sufficient to meet the ROD cleanup criteria at all VPs, with the exception of the Wayne Township (Sheffield) Park and a small right-of-way (ROW) area adjacent to the Pompton Plains Cross Road.

USACE conducted additional excavation and off-site disposal of contaminated residual soils in July and August 2003 at the Wayne Township (Sheffield) Park and the road ROW property consistent with the cleanup levels documented in the ROD. These actions were documented in an *Explanation of Significant Differences* (USACE 2003b). Final Status Surveys performed in compliance with MARSSIM demonstrated that ROD cleanup levels were achieved for radiological and chemical constituents of concern. Approximately 2,300 cubic yards of additional soil were excavated from these two VPs.

The elements of the remedial construction activities including construction QC requirements, USACE inspections, post-excavation final status surveys, and final as-built drawings, are described in the *Post Remedial Action Report Wayne Interim Storage Site Vicinity Properties Wayne Township (Sheffield) Park* (USACE 2008a) and *Post Remedial Action Report Wayne Interim Storage Site Vicinity Properties Pompton Plains Crossroad Right-of-Way*

Property (USACE 2008b). USACE managed and supervised all construction activities at the VPs to ensure compliance with the remedial action work plans and construction specifications. The EPA provided oversight of the cleanup actions.

Transfer of the real property at 868 Black Oak Ridge Road, Wayne Township, New Jersey from the U.S. Government to the Township of Wayne was completed in 2006.

REMEDIAL ACTIONS (INACCESSIBLE SOILS)

After the remediation of the Site, documented in the PRAR, it became necessary to examine the then-current status of a section of Black Oak Ridge Road and Pompton Plains Cross Road that is adjacent to the Site. In August 2004, a characterization survey of this roadway was performed and the results showed areas of subsurface contamination remained along certain roadway and utility features. These findings were also documented in the EPA Five-Year Review, indicating that this area would need to be addressed in the future.

The previously inaccessible soils in this area were made accessible and addressed in 2009 and 2010. During the 2009 remediation at the Black Oak Ridge Road, a total of 13 intermodal containers were filled with 475,000 pounds (237 tons) of contaminated soil and disposed of at US Ecology in Grandview, Idaho (USEI). During the 2010 remediation, 43 containment sacks containing 447,550 pounds (224 tons) of contaminated soil, pipe, and debris were disposed of at USEI.

For radiologically-contaminated soil below the Black Oak Ridge Road roadway, the selected remedy in the ROD, complete excavation and off-site disposal, was applied. All regions of contamination in previously inaccessible soils under the Black Oak Ridge Road have been completely remediated. The analytical data presented in the *Construction Close-Out Report for Roadways and Inaccessible Soils* (USACE 2011) demonstrate compliance with the unrestricted use cleanup criteria as set forth in the ROD. No FUSRAP-related contamination remains in the previously inaccessible areas under the Black Oak Ridge Road, and the Site can be released for unrestricted use per the ROD.

III. MONITORING RESULTS

The cleanup levels for contaminated soils and groundwater at the Site and VPs are listed in Table 1. Attainment of these levels

will allow for unrestricted use and unlimited exposure of the properties, as demonstrated in the risk assessment.

Post remedial action sampling following excavation at the Site property and VPs including the Wayne Township (Sheffield) Park, a small ROW area adjacent to the Pompton Plains Cross Road, and a section of Black Oak Ridge Road. Access was obtained to all properties and soil was excavated. Post excavation sampling indicated all cleanup levels for these soils had been met.

After five years of groundwater monitoring, USACE determined that all monitoring requirements set forth in the ROD had been met. This was stated in the 2008 Five-Year Review Report.

IV. ATTAINMENT OF GROUNDWATER RESTORATION CLEANUP LEVELS

A Long-Term Groundwater Monitoring Program was implemented to monitor groundwater quality at the Site within the unconfined and confined aquifers for a period of five years from the conclusion of remedial activities. Criteria in the ROD were used to evaluate radioactive and chemical constituent results. A total of 21 wells were monitored from 2002 until 2006 in accordance with the *Wayne Interim Storage Site Long-Term Groundwater Monitoring Plan Addendum for USACE In-House Sampling* (USACE 2003a).

Over the course of the five-year monitoring period, a few results did exceed ROD and other criteria, but did not impact the conclusion that all groundwater criteria in the ROD had been met. Arsenic was detected in one well in excess of the ROD criteria, but did not exceed the EPA maximum contaminant level. This well was in a confined aquifer located up-gradient of all former disposal areas and was considered representative of background conditions. Chromium was detected above the ROD criteria in one monitoring well during the May 2006 sampling event. The elevated result was found in a well that was in a confined aquifer located up-gradient of all former disposal areas. The well was considered to be representative of background conditions. The source of the elevated reading was attributed to chromium leaching into the well water column from the stainless steel well casing and screen. Previously, an on-site stainless steel well demonstrated similar elevated chromium results and was replaced by a polyvinyl chloride (PVC) well. The PVC-cased well demonstrated true groundwater chromium much less than the ROD criteria.

Following the March 2006 sampling event, the USACE determined that all monitoring requirements set forth in the ROD had been met. The Five-Year Review Report completed by EPA in September 2008 stated that the groundwater monitoring program requirements, as established in the ROD, had been met. The 21 monitoring wells were abandoned in September 2011 in accordance with New Jersey Department of Environmental Protection regulations, specifically *Well Construction and Maintenance; Sealing of Abandoned Wells*, N.J.A.C. 7:9D.

V. SUMMARY OF OPERATIONS AND MAINTENANCE REQUIRED

No ongoing monitoring or maintenance is required by the U.S. Government at the Site. The remediation of previously inaccessible soils in 2009 and 2010 allowed for the Site to be closed with no land use controls to monitor. Maintenance for the Site is the responsibility of Wayne Township.

VI. DEMONSTRATION OF CLEANUP ACTIVITY QA/QC

Performance standards and QC were described for the project under four categories: general, health physics, environmental monitoring, and safety and health. Work done at the Site was executed under a realistic QC plan to ensure the required standards of quality remediation and construction were met. The QC requirements for the project activities conducted at the Site were prescribed in the *Final Contractor Quality Control Plan (CQCP) Revision 3 - 100% Design Version* (USACE 2001b). The *Final Post Remedial Action Report* (USACE 2004) addressed QC inspections, project meetings, submittal protocol, and field QC. A *Final Contractor Quality Control Plan Addendum* (USACE 2001c) to the CQCP Revision 3 was prepared to describe the QC requirements for project activities relating to long-term groundwater monitoring, and sampling and analysis activities. Work done at the Township Park and ROW VPs was also conducted under this CQCP Revision 3. The work done in 2009 and 2010 to address inaccessible soils in the roadway, however, was done under addendums to the original Site work plans, to include a Contractor QC Plan Addendum.

A quality assurance project plan (QAPP) was also prepared to document results of environmental data operations and provide a project-specific plan for obtaining the type and quality of data required for decision making during execution of remedial

actions at the Site. The QAPP outlined the QA program, QC procedures, sampling, and other technical activities that were applied to environmental operations to verify and maintain the level of data collection required to meet the performance criteria. The QAPP is Part 1 of the *Radionuclide and Chemical Data Quality Management Plan* (USACE 2001d).

VII. FIVE-YEAR REVIEW

The Site achieved construction completion with the signing of the Preliminary Close-Out Report on September 16, 2003, and that date triggered the five-year review requirements. The EPA published a Five-Year Review Report for the Site in September 2008. The assessment of this five-year review was that the selected remedy was functioning as intended by the decision documents and was protective of human health and the environment in the short-term.

The Issues, *Recommendations, and Follow-Up Actions and Protectiveness Statement* of the Five-Year Review both state that "the implemented remedy has left all groundwater and soils suitable for use without restriction, except for two suspected sub-soil areas which are currently not accessible." The areas in question were located beneath a roadway to which the USACE could not gain access for characterization and remediation. The Five-Year Review went on to explain that there were no current risks for either groundwater or soils and none were expected, as long as access controls for the inaccessible areas were maintained, resulting in the likely need for a deed restriction on the areas. Funds made available through the American Reinvestment and Recovery Act of 2009 allowed the USACE to work with Passaic County and remediate the areas. This remediation is documented in the *Construction Close-Out Report for Roadways and Inaccessible Soils* (USACE 2011).

The remediation of previously inaccessible soils under the roadway allowed for the Site to be released for unrestricted use with no need for further Five-Year Reviews.

VIII. SITE COMPLETION CRITERIA

The Site meets all site completion requirements as specified in the OSWER Directive 9320.2-22, *Close-Out Procedures for National Priorities List Sites.* All remedial activities at the Site are complete and the implemented remedy achieves the degree of

cleanup specified in the ROD and ESD, for all pathways of exposure. Therefore, EPA has determined that no further response action is necessary at the Site to protect human health and the environment.

Approved By:

John S. Prince

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

7/10/12
Date

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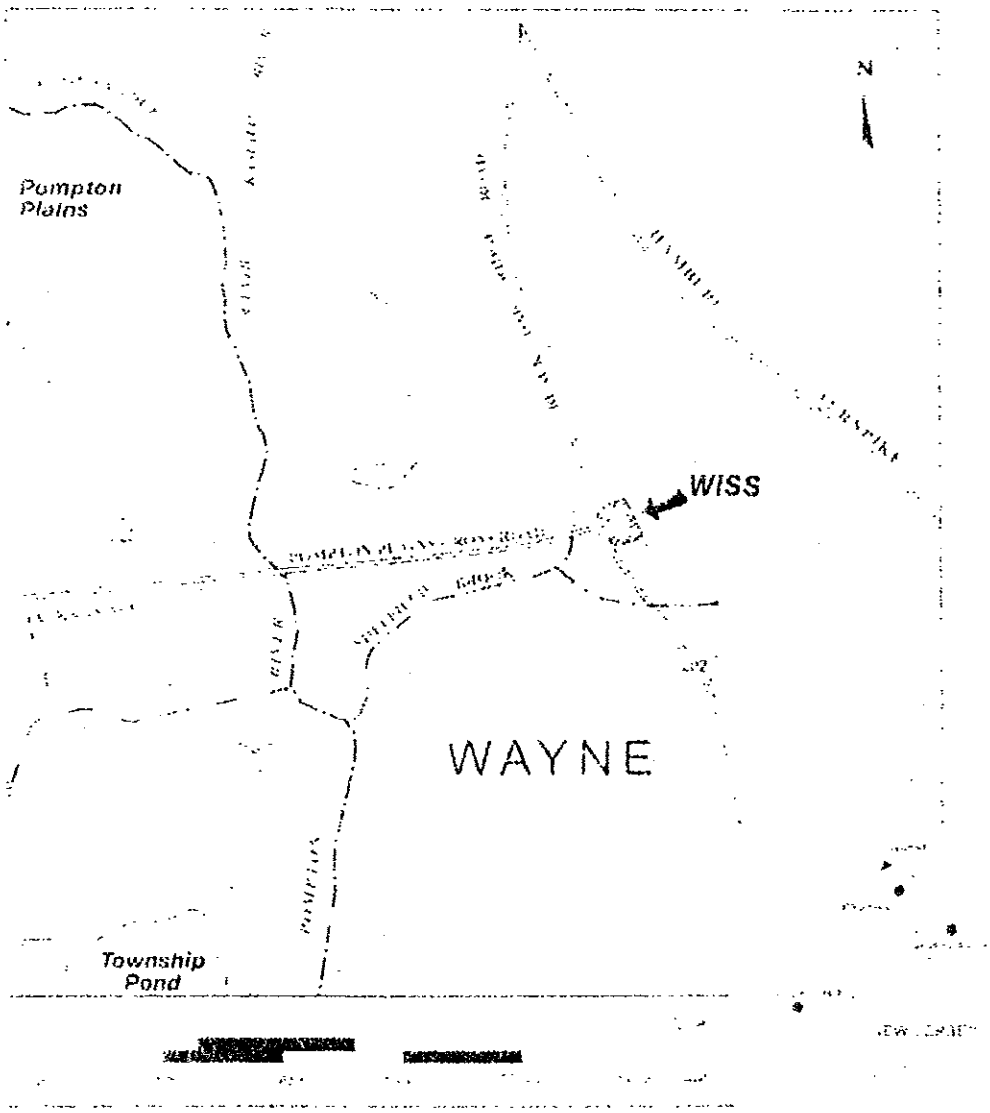

Figure 1. Wayne Site Location Map

Table 1 Soil Cleanup Levels

Metals	Groundwater Criteria Lower of N.J.A.C. 7:10-1, N.J.A.C. 7:9-6.7 or 40 CFR 141 (µg/L)	Selected Criteria Residential Soil Cleanup (mg/kg)	Soil Background[c] (mg/kg)[a]
Antimony	6	5.4[c]	NA
Arsenic	8	20[b]	7.6
Chromium	100	38.4[c]	21.1
Lead	10	400[b]	173
Mercury	2	2[c]	0.32
Molybdenum	No available criteria	72[c]	NA
Thallium	2	2[b]	0.9
Radionuclides	**Groundwater Criteria Lower of N.J.A.C. 7:10-1, N.J.A.C. 7:9-6.7 or 40 CFR 141 (pCi/L)**	**Selected Criteria Residential Soil Cleanup (pCi/g)**	**Soil Background[c] (pCi/g)[a]**
Ra 226 + Ra 228 Combined	5	N/A	N/A
Th-232 + Ra-226 Combined	N/A	5[d,e]	Th-232 – 1.1 Ra-226 – 1.0
Total Uranium	No available criteria	100	4.2 (U-238, U-234)[f]
Gross Alpha (excluding Rn and U)	15	N/A	N/A

[a] Source: *Subsurface Characterization Study for the Wayne Interim Storage Site* (1988)

[b] New Jersey Residential and Non-Residential Soil Cleanup Criteria (Revised May 3, 1999), (N.J.A.C. 7:26D)

[c] Soil cleanup values for direct contact exposure are less restrictive for this contaminant. The more stringent protection of groundwater levels is being proposed as cleanup levels. Concentration protective of groundwater using a dilution-attenuation factor of 20 (Ref: Technical Memorandum for the Determination of Chemical Soil Cleanup Values for Protection of Groundwater for the Wayne Interim Storage Site, June 1999).

[d] Th-232 is substituted for Ra-228 based on assumed equilibrium.

[e] Cleanup level based on site specific risk assessment. Ra-226 + Th-232 = an average concentration of 5 pCi/g above background concentrations for unrestricted residential land use.

[f] U-234 assumed to be in secular equilibrium with U-238.