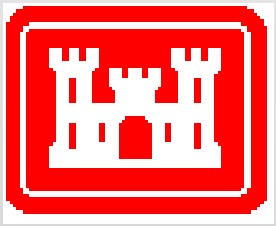
FINAL

RECORD OF DECISION FOR THE RADIOACTIVE WASTE DISPOSAL AREA (RWDA) AT THE W.R. GRACE CURTIS BAY FACILITY BALTIMORE, MARYLAND



U.S. Army Corps of Engineers
Baltimore District

Formerly Utilized Sites
Remedial Action Program

June 2011

FINAL

RECORD OF DECISION FOR THE RADIOACTIVE WASTE DISPOSAL AREA (RWDA) AT THE W.R. GRACE CURTIS BAY FACILITY BALTIMORE, MARYLAND

Prepared for

Formerly Utilized Sites Remedial Action Program (FUSRAP)
U.S. Army Corps of Engineers-Baltimore District

June 2011

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

The subject of this Record of Decision (ROD) is the Radioactive Waste Disposal Area (RWDA) at the W.R. Grace Curtis Bay facility, located at 5500 Chemical Road in Baltimore, Maryland (MD).

STATEMENT OF BASIS AND PURPOSE

This ROD presents the selected remedial action for the RWDA at the W.R. Grace Curtis Bay Facility in Baltimore, MD. The United States Army Corps of Engineers (USACE) is the lead Federal agency for selection of the necessary and appropriate response actions to address radioactive contamination related to work done by W.R. Grace for the Atomic Energy Commission (AEC) at the W.R. Grace Curtis Bay Facility. The Baltimore District, USACE, selected the remedial action in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) [42 U.S.C. 9601 *et seq.*], and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 CFR Part 300]. This decision is supported by the Administrative Record file for the site.

The State of Maryland concurs with the selected remedy, with the stipulation that land use controls be implemented if any soil (surface or subsurface) exceeds the remedial goal for surface soil.

ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF SELECTED REMEDY

Background on the Selected Remedy

Monazite sand processing was conducted at the W.R. Grace Curtis Bay Facility in Baltimore, MD, from mid-May 1956 through the spring of 1957, under a license from the AEC. Monazite sand has naturally occurring radiological components, which include uranium-238 (^{238}U) and

thorium-232 (^{232}Th) and their decay products. Wastes from the processing were disposed in the RWDA. As a result, there is residual radioactive contamination remaining in soils in the RWDA and adjacent boundary areas at the site. The Department of Energy (DOE) identified the W.R. Grace site for inclusion in the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1984. The remedy selected in this ROD is intended to address contamination present at the RWDA and adjacent boundary areas due to monazite sand processing activities conducted by W.R. Grace under contract to the AEC. It is not intended to address contamination that at the site due to activities that were not part of the AEC licensed/contracted operations.

Selected Remedy

The remedy selected for the RWDA site at the W.R. Grace Curtis Bay facility is identified as "Alternative 5: Excavation, Segregation, and Off-Site Disposal" in the Proposed Remedial Action Plan (PRAP) issued in September 2009. The chemical-specific applicable or relevant and appropriate requirement (ARAR) selected by USACE for the site is Title 10 Code of Federal Regulations (CFR) Part 40, Appendix A, Criterion 6(6). This ARAR has been used to determine the remedial goals (RGs) for addressing contaminated soil at the RWDA and adjacent boundary areas. Additional action- and location-specific ARARs have been identified for the selected remedy.

The selected remedy provides for removal and off-site disposal of contaminated soil to meet the RGs identified in this ROD. During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the "as low as reasonably achievable" (ALARA) component of 10 CFR Part 40, Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with U.S. Nuclear Regulatory Commission (NRC) guidance provided in U.S. Nuclear Regulatory Commission (NUREG)-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions. The selected remedy provides for remaining soils to meet standards for an Urban Resident critical group, as this is a foreseeable future use for the area. Demonstration of compliance with the selected chemical-specific ARAR shall be performed using the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC 2000) and other appropriate guidance, as well as appropriate dose modeling codes where necessary, and shall be documented in the Post Remedial Action Report.

In addition, the Final Status Survey contractor will review data collected during the soil segregation and regrading activities. If the data indicates that there is subsurface soil remaining on site with Contaminant of Concern (COC) concentrations in excess of remedial goals for surface soil (sum of fractions for surface soil [($SOF_{surface}$]), land use controls (LUCs) will be

implemented to provide notice as to the location of this soil to protect against unknowing or inadvertent exposures of individuals who may, at some point in the future, disturb the subsurface soil remaining in the RWDA. LUCs will be developed in concert with MDE to include an environmental covenant or similar instrument.

STATUTORY DETERMINATIONS

The remedial action is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the hazardous substances that are the subject of this response action, is cost effective, and uses permanent solutions to the maximum extent possible. The remedial action does not satisfy the statutory preference for treatment as a principal element of the remedy because treatment of the radiological activity at this site is not feasible.

At the completion of the remedial action, an evaluation will be conducted to assess the as-left radiological conditions in the surface and subsurface soils. Based on the results of the evaluation, land use controls may be proposed and implemented at the site. If that is the case, following the 2-year review by USACE to document compliance with the RAO and pursuant to agreement between USACE and DOE, the site would be released to DOE to fulfill any long-term surveillance, operation or maintenance (O&M) responsibilities of the Federal government that are necessary under the selected remedy, to include 5-Year Reviews, if LUCs are implemented. If no land use controls are implemented, USACE will transfer the site to DOE for site stewardship consisting of records management only.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD.

- Radiological materials of concern and their respective concentrations
- Risk associated with radiological materials at the site
- Cleanup levels established for residual radiological material, and the basis for these levels
- Current and reasonable future land use assumptions used in the baseline risk assessment and ROD
- Potential land use that will be available at the site as a result of the selected remedy
- Estimated capital, annual operation and maintenance (O&M), and total costs, discount rate, and the number of years over which the remedy cost estimates are projected
- Key factors that led to the remedy selection; that is, how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria

Peter A. DeLuca
Brigadier General, U.S. Army
Division Engineer

8 SEPTEMBER 2011

DATE

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AEC	U.S. Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirement
BHHRA	Baseline Human Health Risk Assessment
bgs	Below Ground Surface
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	Centimeter
cm^2	Square Centimeters
COC	Contaminant of Concern
COMAR	Code of Maryland Regulations
cpm	Counts per Minute
CWA	Clean Water Act
DCGL	Derived Concentration Guideline Level
DHMH	Department of Health and Mental Hygiene
DOE	U.S. Department of Energy
dpm	Disintegrations per Minute
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSS	Final Status Survey
FUSRAP	Formerly Utilized Sites Remedial Action Program
ft	Foot/Feet
G&M	Geraghty and Miller
gr/SCFD	Grains per Standard Cubic Foot
HEPA	High Efficiency Particulate Air
in	Inch(es)

LUC	Land Use Control
m	Meter
m^2	Square Meters
m^3	Cubic Meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCL	Maximum Contaminant Level
MD	Maryland
MDE	Maryland Department of the Environment
MED	Manhattan Engineering District
mg/dscm	Milligrams per Standard Cubic Meter
mrem/hr	Millirem per Hour
mrem/yr	Millirem per Year
NCP	National Contingency Plan
NCRPM	National Council on Radiation Protection and Measurements
NPDES	National Pollutant Discharge Elimination System
NRC	U. S. Nuclear Regulatory Commission
NUREG	U.S. Nuclear Regulatory Commission
NUS	Nuclear Utilities Services
ORNL	Oak Ridge National Laboratory
O&M	Operation and Maintenance
PCB	Polychlorinated Biphenyl
pCi/m^2s	Picocuries per Square Meter per Second
pCi/g	Picocurie per Gram
PL	Public Law
PM	Particulate Matter
PRAP	Proposed Remedial Action Plan
PV	Present Value
Ra	Radium
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactivity (Computer Code)
RG	Remedial Goal

RI	Remedial Investigation
RMC	Radiation Management Corporation
ROD	Record of Decision
RWDA	Radioactive Waste Disposal Area
SARA	Superfund Amendments and Reauthorization Act
SOF	Sum of Fractions
SPDES	State Pollutant Discharge Elimination System
SU	Survey Unit
TBC	To Be Considered
TEDE	Total Effective Dose Equivalent
Th	Thorium
TSCA	Toxic Substances Control Act
U	Uranium
USACE	U. S. Army Corps of Engineers
yd^3	cubic yard
µg/kg	microgram per kilogram
µg/L	microgram per liter
µR/hr	micro Roentgens per hour

DECISION SUMMARY

1. SITE NAME, LOCATION, AND DESCRIPTION

Radioactive Waste Disposal Area (RWDA)
W.R. Grace Curtis Bay Facility
Baltimore, Maryland (MD), 21226-1604

1.1 Regulatory Oversight and Enforcement

The United States Army Corps of Engineers (USACE) is the lead Federal agency for selection of the necessary and appropriate response actions to address radioactive contamination related to work done by W.R. Grace for the Atomic Energy Commission (AEC) at the W.R. Grace Curtis Bay Facility site. The Maryland Department of the Environment (MDE) is the lead State agency for the site, on behalf of and in consultation with the Environmental Protection Agency (EPA). The Baltimore District of USACE (USACE-Baltimore) conducted remedial investigative activities at the RWDA and will perform or oversee performance of a remedial action at the W.R. Grace Curtis Bay facility to address the threat to human health created by the presence of residual radioactivity in the RWDA and adjacent boundary areas. The investigative and remedial activities are being conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The Department of Energy (DOE) began the FUSRAP program in 1974 to address potential contamination at sites due to the processing of radioactive materials for the Manhattan Engineering District (MED) and the AEC. The W.R. Grace Curtis Bay Facility was placed in the FUSRAP in 1984. USACE acquired responsibility for the administration and execution of the FUSRAP program in 1997.

1.2 Site and Vicinity Land Use

The W.R. Grace Curtis Bay Facility presently occupies 109.7 acres on an industrialized peninsula at 5500 Chemical Road in Baltimore, MD. The Curtis Bay facility consists of a manufacturing plant on the western portion of the site and a non-manufacturing area on the eastern section (Figure 1). The W.R. Grace property is bordered on the north by Curtis Bay, on the west by Curtis Creek, on the east by the U.S. Gypsum Co., and on the south by the Quarantine Road Municipal Landfill, Blue Circle, Inc., and Republic Services, Inc. The RWDA is located within the non-manufacturing portion of the facility to the east of Herring Pond, to the south of Curtis Bay, to the north of dredge spoils ponds, and to the west of a filter cake disposal cell.

1.3 Zoning and Future Land Use

The land is currently zoned for industrial use. Potable water service is provided by the City of Baltimore. The RWDA is currently unused but may be used for industrial purposes in the foreseeable future.

1.4 Site Overview

In the 1950s, W.R. Grace processed monazite sand at the W.R. Grace Curtis Bay facility to extract the radioactive element thorium under a contract with the AEC. The processing was conducted in the southwest quadrant of Building 23, which is located in the manufacturing plant on the western portion of the site. Building 23 is currently being addressed as a separate FUSRAP response action, in accordance with the *Record of Decision for Building 23 at the W.R. Grace Curtis Bay Facility, Baltimore Maryland* (USACE 2005). Waste materials from the processing operations (termed "gangue") were placed in the RWDA. The gangue consisted primarily of silica, calcium sulfate, iron sulfate, diatomaceous filter aid, and unreacted monazite sands, which contained traces of thorium and uranium (and decay progeny) and rare earth metals. Approximately 26,000 cubic yards (yd^3) of gangue was reported to have been buried with other miscellaneous equipment, rare earth double salt, filter cloths, and mechanical scrap in the landfill. The RWDA also contains general waste including rock, refuse (glass, paper, wood, and metal), and dredge spoils. Radioactive waste was believed to be buried at various depths up to 9 feet (ft), but may be as deep as 25 ft. The RWDA is the subject of this Record of Decision (ROD). Additional information pertaining to the site is currently available at the following public information repositories:

USACE Baltimore District offices
City Crescent Building, Room 10200
10 South Howard St.
Baltimore, MD 21201

Enoch Pratt Free Library, Brooklyn Branch
300 Patapsco Avenue
Baltimore, MD 21225

2. SITE HISTORY AND INVESTIGATIONS

The following sections describe the historical activities that led to the inclusion of the RWDA in the FUSRAP. Also included is a summary of past investigations at the site leading up to and including the investigations conducted by USACE-Baltimore. Detailed information about the site history and previous investigations is included in the public information repositories.

2.1 History of Monazite Processing Operations

A five-story plant constructed in the southwest quadrant of Building 23 at the W.R. Grace Curtis Bay Facility in Baltimore, MD, was used for the processing of monazite sand, which has naturally-occurring radiological components. These radiological components include uranium-238 (^{238}U) and thorium-232 (^{232}Th) and their decay products. The AEC issued W.R. Grace a license to receive, possess, and process monazite sand. In mid-May 1956, W.R. Grace, under contract to the AEC, began the processing of monazite sand primarily for the extraction of source material in the form of ^{232}Th, as well as the extraction of rare earth elements. The products of the monazite sand processing were reported to be crude thorium hydroxide and rare earth sodium sulfate.

W.R. Grace ceased monazite sand processing operations for the AEC at the Curtis Bay facility in the spring of 1957. As a result of the processing operations at W.R. Grace, certain building components in the southwest quadrant of Building 23 were impacted by radionuclides, and soil under the southwest quadrant may have been impacted by radionuclides. As discussed in Section 1.4, the southwest quadrant of Building 23 is subject to a separate remedial action being conducted by USACE-Baltimore. The wastes created by the processing operations in Building 23, as well as some of the processing equipment, were disposed in the RWDA. At the time of the burial, AEC did not have regulations prohibiting disposal of the gangue in the RWDA. As a result of the disposal activities, residual radioactivity remains in soils in the RWDA and in adjacent boundary areas. The W.R. Grace Curtis Bay site was identified by DOE for inclusion in FUSRAP in 1984.

2.2 Site Investigations and Studies

In 1978, Radiation Management Corporation (RMC) performed a radiological survey of the RWDA for W.R. Grace to measure external radiation levels at the "Curtis Bay Waste Disposal Area" and to investigate the possible migration of radioactive material from the deposit site. RMC drilled borings in the RWDA, and collected and analyzed soil samples. Their results indicated that external gamma radiation levels ranged from background to 17 millirem per hour (mrem/hr), and were elevated in two general areas. Elevated radiation levels were observed at 15 ft below ground surface (bgs), and measured thorium concentrations in one boring were 6.2 picocuries per gram (pCi/g) at 5 ft bgs and 97 pCi/g at 15 ft bgs. RMC concluded that the radioactive material was not uniformly deposited throughout the RWDA, and the exact quantity of radioactive material was unknown. However, RMC estimated that the total volume of waste material possibly containing monazite residue (in the two locations identified by RMC) was approximately 704,000 ft^3 (26,000 yd^3). RMC also collected and analyzed plant material. No thorium daughter products were detected in the plant material analyzed (RMC 1978).

Between 21 and 23 July 1979, EG&G Energy Measurements Group performed an aerial radiological survey of the Curtis Bay Facility. The EG&G survey verified the presence of thallium-208 (^{208}Tl), actinium-228 (^{228}Ac), bismuth-214 (^{214}Bi), and potassium-40 (^{40}K). The results indicated elevated gamma exposure rates and thorium levels in three areas of the W.R. Grace Curtis Bay facility: the maintenance-dredging settling pond in the northwest corner of the site; the area northeast of Building 23; and the third area, which had the highest concentrations, centered over the RWDA (U.S. DOE 1979).

In April and October 1979, the Oak Ridge National Laboratory (ORNL) conducted a preliminary radiological survey of the facility to gather sufficient information to allow site preparation subcontracts to be put in place (U.S. DOE 1979). A walkover gamma scan was conducted for a 40-acre tract, which included the RWDA (U.S. DOE 1990). The survey detected elevated gamma radiation levels (up to 50 micro Roentgens per hour [μR/hr]) at 3 ft above surface level in several locations outside the RWDA. Gamma exposure rates above 3,000 μR/hr were detected in localized areas within the RWDA. ORNL delineated the RWDA by using concrete benchmarks in anticipation of conducting a study in Fall 1983 (NUS Corporation 1984).

A waste disposal survey prepared by a U.S. congressional committee (The Eckhardt Report) in 1979 listed the W.R Grace Curtis Bay Facility as a disposal area for hazardous and industrial waste from 1909 through 1978. According to the report, "The amount of chemical process waste disposed at this site through 1978 was reported at 118,500 tons." The waste was described as being composed of acid solutions (pH < 3), base solutions (pH > 12), heavy and trace metals, inorganic compounds, and radioactive residues with elevated gamma levels (> 50 pCi/g). Methods of disposal included use of mixed industrial waste landfills and pits, ponds, and lagoons. The report stated that because large amounts of chemical waste were disposed onsite, mixed radioactive and chemical wastes were likely to be present (U.S. Government/Eckhardt Report 1979).

Geraghty and Miller (G&M) under contract to W.R. Grace conducted a geologic and hydrogeologic investigation of the area east of Herring Pond in 1980 to assess the area's suitability for a sludge cake (wastewater treatment plant filter cake) disposal cell (G&M 1980). G&M reported very low pH levels, very high dissolved solids content and "high" levels of inorganics including chromium, lead, and zinc in the groundwater. G&M attributed these results to older waste disposal operations, rather than the storage of filter cake.

In 1981, G&M conducted a geologic and hydrogeologic investigation of the area surrounding a newly constructed sludge cake disposal cell located east of Herring Pond (G&M 1981). Low

levels of metals (above detection limits) and low pH levels (3.8 to 5.4) were reported in the groundwater of the study area.

JRB Associates, under contract to EPA Region III, was directed by the EPA to assist State of Maryland Department of Health and Mental Hygiene (DHMH) personnel in conducting its "Dumpsite Assessment" program (JRB Associates 1982). On 12 November 1981, JRB Associates and DHMH personnel travelled to the eastern portion of the site and observed several waste cells which were used for trash, non-hazardous waste, and wastewater sludge. The inspection team identified metal slag remnants and construction rubble strewn about the area between the settling ponds. Radiation levels of five to six times background were reported (110-120 counts per minute [cpm]; background was reported as 10-20 cpm) in the RWDA. Recommendations by JRB Associates included sampling of onsite wells (constructed in a prior study) for radionuclides and onsite mapping of radioactive areas using more sensitive detection equipment.

A site investigation was conducted by the State of Maryland DHMH on 7 December 1982 on the low-level radioactive areas reported to be present by JRB Associates at the W.R. Grace Curtis Bay Facility (State of Maryland DHMH 1982). DHMH personnel traversed the site, which included the area adjacent to Herring Pond (currently identified as the RWDA) and conducted a radiological survey. Readings above background levels (250-350 cpm) were reported at three areas inside the RWDA. The first area (near the southeast corner of the RWDA) was reported to be 20,000 cpm (0.25 mrem/hr), the second area (located along the western boundary of the RWDA) was 24,000 cpm (0.7 mrem/hr), and the third area (located in the western part of the RWDA) reportedly had a reading of 7 mrem/hr (the converted cpm reading for this location was not reported). DHMH personnel reported that in two of the survey areas, monazite gangue was located on the surface. DHMH personnel also reported that the RDWA was vegetated with weeds and small trees (mainly black cherry) and that the site was mostly flat with the exception of some small depressions and swales. DHMH personnel also noted that the site was fenced in; however, it was also not completely secure.

Nuclear Utilities Services (NUS) conducted a site inspection of the W.R. Grace Facility on 15 March 1983 and submitted a report in August 1984 (NUS Corporation 1984). The analytical results from samples collected during the inspection indicated several carcinogenic and toxic priority pollutants present in two downgradient onsite monitoring wells. In addition, low levels of various heavy metals and somewhat higher concentrations of arsenic (30,000 micrograms per kilogram [μg/kg]) were reported in a composite soil sample of the sludge cells. Metals including arsenic (up to 500 micrograms per liter [μg/L]) were reported in a groundwater sample from an existing well (in the area of the RWDA). Arsenic and other metals were also reported in a surface

water sample from Herring Pond (700 μg/L of arsenic). NUS documented that no liners, leachate collection systems, or gas collection systems were used by W.R. Grace in its waste management practices.

In May 1984, G&M was contracted by W.R. Grace to install three wells (GM-16, GM-17, and GM-18) downgradient of the proposed spoils pond (Spoils Pond No. 2) and to perform an initial well analysis (i.e., prior to operation of the spoils pond) for each of the wells (G&M 1984). The wells were to be installed and monitored so that W.R. Grace would be in compliance with DHMH requirements for operation of a spoils pond. The wells were subsequently sampled, and groundwater samples were analyzed for solids, organics, and inorganics (including ammonia, bicarbonate, calcium, carbonate, chloride, copper, chromium, iron, lead, magnesium, nickel, nitrate, sodium, sulfate, and zinc). Low levels of metals and low pH levels were reported in the groundwater results.

The FUSRAP Environmental Compliance Assessment Program was developed to help ensure compliance with applicable federal, state, and local pollution regulations at FUSRAP sites. The 1990 FUSRAP report presents the results of an environmental compliance assessment completed by DOE of W.R. Grace's Curtis Bay Facility (U.S. DOE 1990). Its purpose was to evaluate the compliance of the site with the appropriate federal regulations and statutes (Resource Conservation and Recovery Act [RCRA], Toxic Substances Control Act [TSCA], Clean Air Act [CAA], Clean Water Act [CWA]) regarding hazardous waste, polychlorinated biphenyls (PCB), air emissions, and wastewater discharges. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements were not addressed in this assessment, nor did the assessment cover the management and disposal of radioactive material, unless that material is mixed with a hazardous waste as defined by RCRA. Radioactive waste management is addressed under CERCLA. The overall review process included a review of records, reports, and files and consultation with Bechtel National Inc. personnel. The report indicates that approximately 28,000 cubic meters (m^3) (36,000 yd^3) of contaminated gangue from thorium processing was buried along with other contaminated materials in a 4-acre landfill for radioactive waste.[1] The Hazardous Waste Management review (pertinent to RCRA) indicated that no hazardous waste was being disposed in the radioactively contaminated waste landfill at the time of the survey. It was noted that, in addition to the radioactive waste, the landfill also contained large amounts of other waste materials (glass, paper, wood, metal, and dredge spoil), which may be a characteristic RCRA waste. The report also states that the potential for RCRA-listed waste to

[1] A radiation survey completed by RMC for Davison Chemical Company, Division of W.R. Grace & Co. states that 704,000 ft3 (which converts to approximately 26,000 yd3) of radiological material were present at the site. However, BNI states in a 1989 report that 36,000 yd3 of radiological material were present in the RWDA. It appears that the number presented by BNI is not accurate; therefore, the number 26,000 yd3 was used.

be located in the radioactively contaminated waste landfill is unknown. The PCB Management review (pertinent to TSCA) revealed that there were no data available indicating the possible existence of PCB contamination at the site. The Air Emissions review (pertinent to the CAA) revealed that DOE holds no state or federal permits for emissions of hazardous air pollutants at the W.R. Grace Facility. Also, no asbestos was identified by DOE at the site. The wastewater discharges review (pertinent to CWA) indicated no point source discharges and stated that DOE holds no National Pollutant Discharge Elimination System (NPDES) or State Pollutant Discharge Elimination System (SPDES) permits for the W.R. Grace site. The report indicated that sampling and analysis of landfill material for RCRA characteristics and PCB should be conducted prior to any excavation.

On October 13, 1997, the Energy and Water Development Appropriations Act, Public Law (PL) 105-62, was signed into law transferring the responsibility for the administration and execution of FUSRAP from DOE to USACE. In 1999/2000, USACE-Baltimore conducted a Remedial Investigation (RI) at the RWDA (EA 2001). A Baseline Human Health Risk Assessment and Tier 1 Ecological Risk Assessment were prepared as part the RI. The principal AEC-related radiological components of monazite sand identified during the RI included ^{238}U and ^{232}Th and their decay products. In 2005, supplemental surveying and sampling activities were conducted by USACE-Baltimore (EA 2005). The primary objectives of the work were to evaluate whether FUSRAP-related contaminants of concern (COCs) were present outside the fenced boundary of the RWDA and to collect radiological survey and sample data to help support the Final Status Survey (FSS) design for these areas. Results of the supplemental sampling indicated that AEC-related radiological components of monazite sand are present in boundary areas of the RWDA. In 2008, USACE-Baltimore finalized the Feasibility Study (FS) for the RWDA, which identified and screened remedial action alternatives for the site (Tetrahedron 2008). In September 2009, USACE-Baltimore completed the Proposed Remedial Action Plan (PRAP), which identified the USACE-preferred alternative for remedial action (EA 2009). The RI, risk assessments, FS, and PRAP are available in the public information repository, as discussed in Section 1.4 of this document. Additional details pertaining to site contamination are presented in Sections 5 and 6 of this ROD.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Public response and input was encouraged to ensure that the remedy selected for the RWDA at the W.R. Grace Curtis Bay facility would meet the needs of the local community, in addition to being an effective solution to the problem. The final versions of the RI Report, supplemental sampling results, and Feasibility Study (FS), which were issued in July 2001, October 2007, and September 2008, respectively, were included in the Administrative Record for the site. A news release was published in *The Baltimore Sun* on September 27, 2009, announcing the issuance of

the PRAP and the date of the public meeting (October 7, 2009) to provide information about the remedial action and the opportunity to submit comments on the PRAP. In addition, announcement letters were mailed on September 28 and 29, 2009 to the following community groups, politicians, and regulatory agencies: Community of Curtis Bay Association, Brooklyn and Curtis Bay Coalition, Brooklyn-Curtis Bay Ministerial Alliance, Concerned Citizens for a Better Brooklyn, Baybrook Eco Watch, South Baltimore Community Advisory Panel, various local residents, City of Baltimore Department of Planning, U.S. Senator Benjamin L. Cardin, U.S. Senator Barbara A. Mikulski, U.S. Congressman Dutch Ruppersberger, Maryland State Senator George W. Della, Jr., Maryland State Delegate Carolyn J. Krysiak, Maryland State Delegate Peter A. Hammen, Maryland State Delegate Brian K. McHale, Baltimore City Mayor Sheila Dixon, the EPA (Region III), the MDE, W.R. Grace Curtis Bay Facility, and Grace Davison Headquarters.

The PRAP and public comment period were advertised to the public as starting on the 27th of September 2009. The comment period ended on October 27, 2009. The public meeting was held as planned on October 7, 2009. A summary of the significant comments received during the public comment period and USACE responses are presented in the responsiveness summary, which is provided in Appendix A of this ROD. A summary transcript of the public meeting is included in Appendix B.

4. SCOPE AND ROLE OF THE REMEDIAL ACTION

The W.R. Grace Curtis Bay site contains two separate areas (Building 23 and the RWDA) which are being investigated under FUSRAP. As previously discussed, the southwest quadrant of Building 23, (addressed in a separate ROD), is the subject of an ongoing remedial action being conducted by USACE-Baltimore. The planned remedial action for the RWDA and surrounding boundary areas involves the cleanup of residual radioactivity to meet the remedial goals (RGs) established in this ROD. The selected remedy provides for remaining soils to meet standards for an Urban Resident critical group, as this is a foreseeable future use for the area. The radionuclides of concern at the RWDA are those associated with the processing of monazite sand that occurred in the southwest quadrant of Building 23 under contract with the AEC. FUSRAP contamination at the RWDA and boundary areas primarily contains ^{232}Th and its decay progeny. ^{238}U and its decay progeny may also be present; however, the ^{232}Th decay series also must be present at elevated levels for materials to be classified as FUSRAP waste. A FSS will be conducted in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC 2000) to verify that RGs have been met. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM. In addition, at the completion of the remedial action, an evaluation will be conducted to assess the as-left radiological conditions in the surface and subsurface soils. Based on the results of the evaluation, land use controls may be proposed and implemented at the site.

A Remedial Action Objective (RAO) was established based on a review of potentially applicable relevant and appropriate requirements (ARARs) as defined in CERCLA. Descriptions of the ARARs and the ARAR-based RAO established for the RWDA, along with "to be considered" (TBC) guidance are summarized in the following sections. The scope of the remedial action required to meet the RAO is also discussed below.

4.1 Applicable or Relevant and Appropriate Requirements

Agencies responsible for remedial actions under CERCLA must ensure that the selected remedies meet ARARs. The following sections define ARARs adopted by USACE-Baltimore for cleanup of the RWDA site. [Note: Only ARARs pertaining to the selected remedy, "Alternative 5: Excavation, Segregation, and Off-Site Disposal", are included below. Refer to the Feasibility Study (Tetrahedron 2008) for ARARs which were identified for other alternatives, but which do not apply to the selected remedy.]

4.1.1 ARARs as Defined in CERCLA

The ARAR selection process is presented in CERCLA Section 121 and the National Contingency Plan (NCP). The NCP defines *applicable requirements* as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal and/or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site. *Relevant and appropriate requirements* are defined as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not ''applicable'' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Determination of ARARs is site-specific and depends on chemical and radiological constituents present, site/location characteristics, and remedial actions under consideration for remediation of the site. State environmental requirements may be applicable or relevant and appropriate if they are more stringent than Federal requirements, promulgated, generally applicable, consistently applied, legally enforceable, and identified by the State in a timely matter. If not consistently applied in similar circumstances, a state ARAR may be waived. The agency responsible for remedial actions under CERCLA must ensure that the selected remedy meets the ARARs.

ARARs can be classified as chemical-, action-, or location-specific:

- **Chemical-specific ARARs** - establish health-based concentration limits in various environmental media for specific hazardous substances or pollutants. These requirements establish the protective cleanup levels for the COCs present in the designated media.

- **Location-specific ARARs** - may affect or restrict remedial and site activities. Generally, location-specific requirements serve to protect the individual site characteristics, resources, and specific environmental features.

- **Action-specific ARARs** - focus on remedial activities occurring within the site. These requirements pertain to the methods of storage, transportation, and disposal of hazardous substances, as well as onsite construction of facilities or treatment processes. Other action-specific requirements may pertain to air quality, wastewater management, and erosion/sediment control.

In addition to ARARs, advisories, criteria, or guidance may be identified as "to be considered" (TBC) information for a particular scenario that may be useful in developing CERCLA remedies. TBC information may be developed by EPA, other Federal agencies, or states. TBCs are typically considered only if no promulgated requirements exist that are either applicable or relevant and appropriate. ARARs and TBC guidance selected by USACE-Baltimore for the site are summarized in Table 4-1 and discussed in detail below.

TABLE 4-1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

REQUIREMENT/GUIDANCE	CITATION	ARAR STATUS	DESCRIPTION OF REQUIREMENT/GUIDANCE
CHEMICAL-SPECIFIC ARARs			
Clean-up Criteria for Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content	10 CFR Part 40, Appendix A, Criterion 6(6)	Relevant and appropriate requirement for radiological contamination of soil at the RWDA and adjacent boundary areas.	The total effective dose equivalent (TEDE) from radionuclides (excluding radium) must not exceed the benchmark TEDE derived from the radium standard of 5 pCi/g radium above background in the top 15 cm or 15 pCi/g above background in the subsurface and must be As Low As Reasonably Achievable (ALARA). When more than one radionuclide is present in the same 100 square meter area, the sum of ratios must be less than 1.
LOCATION-SPECIFIC ARARS			
Mitigation of Nontidal Wetlands	Code of Maryland Regulations (COMAR) 26.23.04.02 B(1)	Applicable requirement to avoid and minimize the destruction of nontidal wetlands during remedial activities.	Requirement is applicable for mitigation of nontidal wetland areas if wetland alteration/destruction cannot be avoided during remedial action. This requirement is applicable for approximately 0.9 acres of nontidal wetlands within the RWDA and adjacent boundary areas. Substantive standards will be met – no permit is required. Mitigation, if necessary, will be developed with MDE in accordance with COMAR 26.23.04.03 C.
Mitigation of Tidal Wetlands	COMAR 26.24.05.01 B(1)	Applicable requirement to avoid and minimize the destruction of tidal wetlands during remedial activities.	Requirement is applicable for mitigation of tidal wetland areas if wetland alteration/destruction cannot be avoided during remedial action. This requirement is applicable for tidal wetlands north of the RWDA. Substantive standards will be met – no permit is required. Mitigation, if necessary, will be developed with MDE in accordance with COMAR 26.24.05.01 B(4).

REQUIREMENT/GUIDANCE	CITATION	ARAR STATUS	DESCRIPTION OF REQUIREMENT/GUIDANCE
ACTION-SPECIFIC ARARS			
Numerical Criteria for Toxic Substances in Surface Water	COMAR 26.08.02.03-2	Applicable to all alternatives where water is discharged to surface water bodies.	Requirement identifies criteria for toxic substances, which are applied at the edge of mixing zones for water discharges to surface water bodies. Discharge water may be generated during excavation (dewatering) or during treatment activities.
Air Emissions Standards for Particulate Matter (PM)	COMAR 26.11.06.03 (D)	Applicable for remedial alternatives where particulate matter will become airborne.	Requirements specify emissions limits on PM air emissions from materials handling and construction..
Well Installation and Maintenance	COMAR 26.04.04.07 B, D through L, M(2), and O	Applicable for remedial alternatives requiring dewatering activities.	Requirements specify construction standards for well construction.
Well Abandonment	COMAR 26.04.04.11(D)(1), (D)(2)(a)-(b), (E), (F), (G)	Applicable for remedial alternatives requiring dewatering activities.	Requirements specify the materials and procedures for sealing and filling abandoned wells.
TO-BE-CONSIDERED (TBC) GUIDANCE			
Residual Surface Activity Limits	NRC Guidance Directive FC 83-23	Guidance establishes limits on surface contamination levels for release for unrestricted use.	Relevant for release of concrete debris and other non-soil materials encountered during remedial action. Limits are provided (in dpm/100m^2) for average, maximum, and removable activities.

4.1.2 Chemical-Specific ARAR

The chemical-specific ARAR selected by USACE-Baltimore for the RWDA site is 10 CFR Part 40, Appendix A, Criterion 6(6), which specifies:

> *The design requirements in this criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which, as a result of byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.*
>
> *Byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose) and must be at levels which are as low as reasonably achievable. If more than one residual radionuclide is present in the same 100 square meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity).*

The standards found in Appendix A of 10 CFR Part 40, titled "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Waste Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content" are considered relevant because the residual activity in the RWDA is the result of milling operations conducted under an AEC license in the 1950s primarily for the extraction of ^{232}Th.[2] The standards are considered appropriate in that they address the cleanup of thorium processing by-product material containing all isotopes within the thorium decay chain, not just radium and radon. As defined in 10 CFR Part 40, byproduct material is the tailings or wastes produced by the extraction of uranium or thorium from any ore (e.g. monazite sands) processed primarily for its source material content.

Criterion 6(6) of Appendix A, 10 CFR Part 40, states that byproduct material containing concentrations of radionuclides other than radium in soil (e.g. thorium and uranium) must not result in a TEDE to the average member of a critical group exceeding the benchmark dose. The

[2] The introduction to Appendix A expressly states that the appendix applies to thorium mills, as well as uranium mills.

benchmark dose at thorium milling sites is associated with ^{228}Ra. The benchmark dose is derived from an activity of 5 pCi/g averaged for surface soils within the first 15 cm and 15 pCi/g within subsurface soils below the first 15 cm. These radium limits apply to radionuclide concentrations above background levels.

In addition to the use of the benchmark dose for determination of RGs, 10 CFR Part 40, Appendix A, Criterion 6(6), requires "that residual radioactivity has been reduced to levels that are as low as reasonably achievable." 10 CFR Part 40, Appendix A, refers to 10 CFR section 20.1003 for the definition of ALARA, which is as follows: "making every reasonable effort to maintain exposures to radiation as far below the dose limits of this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvement in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest." 10 CFR Part 40, Appendix A, provides no specific method for measuring ALARA. Therefore, the cost-versus-benefit type of analysis provided by the U. S. Nuclear Regulatory Commission (NRC) in U.S. Nuclear Regulatory Commission (NUREG)-1757, "Consolidated Decommissioning Guidance: Decommissioning Process for Materials Licensees" (NRC 2006), will be utilized during the remedial design for the selected alternative to determine if additional actions are required to address the ALARA component of this ARAR, and the analysis will be updated, as needed, based on actual construction conditions.

4.1.3 Location-Specific ARARs

Two location-specific ARARs have been selected by USACE.

4.1.3.1 Mitigation of Nontidal Wetlands

The Maryland regulation titled "Mitigation for Regulated Activities," at COMAR 26.23.04.02 B(1), states:

> *A permittee shall take all necessary steps to first avoid adverse impacts and then minimize losses of nontidal wetlands. If the permittee demonstrates to the Department's satisfaction that losses of nontidal wetlands are unavoidable and necessary, the Department shall require the permittee to develop and implement mitigation practices.*

Nontidal wetlands were identified by EA Engineering in 1999 within the RWDA fence line (approximately 0.9 acres) and east of the RWDA (in the adjacent boundary area). With regard to the remedial action, the above State ARAR, COMAR 26.23.04.02 B(1), calls for all necessary steps be taken to first avoid adverse impacts and then minimize losses of nontidal wetlands.

Mitigation is required if losses of nontidal wetlands are unavoidable and necessary. Wetland mitigation, if necessary, will be developed in accordance with COMAR 26.23.04.03 C. As indicated in COMAR 26.23.04.02 A, no mitigation is required for wetland buffers, which COMAR defines as "a regulated area, 25 feet in width, surrounding a nontidal wetland, measured from the outer edge of the nontidal wetland."

The substantive requirements of this regulation are applicable to the site to the extent that the presence of wetlands is verified at the time of the remedial action. If verified, the substantive requirements of this regulation are applicable to remedial actions involving excavation, covering and/or capping where existing nontidal wetlands may be adversely impacted or lost.

4.1.3.2 Mitigation of Tidal Wetlands

COMAR 26.24.05.01 B(1), titled "Mitigation," states:

> *An applicant for a license or permit shall design a project to first avoid and then minimize the loss of tidal wetlands. If an applicant demonstrates that alteration of tidal wetlands cannot be avoided to accomplish the project, the Department shall:*
>
> *(a) Recommend that the Board require mitigation as a condition of a State tidal wetlands license; or*
>
> *(b) Require mitigation as a condition of a private tidal wetlands permit.*

Tidal wetlands were identified north of the RWDA fence line. With regard to the remedial action, the above State ARAR, COMAR 26.24.05.01 B(1), calls for steps be taken first to avoid and then minimize the loss of tidal wetlands. However, if alteration or destruction of tidal wetlands cannot be avoided, then mitigation is required. Wetland mitigation, if necessary, will be developed in accordance with COMAR 26.24.05.01 B(2), which indicates that mitigation will replace the value and function of the adversely affected (or lost) wetland.

The substantive requirements of this regulation are applicable to the site to the extent that the presence of wetlands is verified at the time of the remedial action. If verified, the substantive requirements of this regulation are applicable to remedial actions involving excavation, covering and/or capping where existing tidal wetlands are adversely impacted or lost.

4.1.4 Action-Specific ARARs

Four Federal and State action-specific ARARs have been selected by USACE for the remedial alternatives that were considered for the site.

4.1.4.1 Numerical Criteria for Toxic Substances in Surface Water

A State action-specific ARAR specifying numerical toxic substances limits for surface water is COMAR 26.08.02.03-2 titled, "Numerical Criteria for Toxic Substances in Surface Waters."

The federal Clean Water Act establishes the NPDES permit program in 40 CFR Part 122. Per COMAR 26.08.04.07, the State of Maryland is authorized to administer the Federal NPDES program and is responsible for satisfying the regulatory requirements of NPDES. COMAR 26.08.04 contains the permit application procedure and identifies conditions for obtaining such permits for discharges to the surface waters of Maryland. CERCLA section 121(e)(1) provides for exemption from obtaining a permit as to on-site remedial actions. The location of discharges necessary for the implementation of the remedy are on-site for purposes of CERCLA section 121(e)(1). However, we will comply with the applicable or relevant and appropriate substantive requirements. For this site, the numerical criteria contained in COMAR 26.08.02.03-2 are substantive requirements that are applicable at the edge of the mixing zones.

COMAR 26.08.02.03-2 is applicable to actions that result in discharge of water due to dewatering for management of excavations and discharge of process waters associated with treatment processes. Because the remedial action to be conducted will be addressed as a CERLCA remedial action, a permit need not be obtained as to the on-site remedial activities. However, the remedial action will comply with the applicable or relevant and appropriate substantive requirements.

4.1.4.2 Air Emissions Standards for Particulate Matter

The State ARAR pertaining to air emissions of particulate matter (PM) is COMAR 26.11.06.03 (D), titled, "Particulate Matter". This ARAR sets standards for particulate matter from materials handling and construction..

Particulate Matter from Materials Handling and Construction: may not cause or permit any material to be handled, transported, or stored, or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne.

4.1.4.3 Well Installation and Maintenance

The state ARAR, COMAR 26.04.04.07 B, D through L, M(2), and O, specifies construction standards for wells.

4.1.4.4 Well Abandonment

The State ARAR concerning well abandonment is COMAR 26.04.04.11 (D)(1), (D)(2)(a)-(b), (E), (F), and (G). This standard specifies the materials and procedures for filling abandoned

wells. These requirements apply to abandonment of existing wells in order to accommodate the remedy, abandonment of dewatering wells installed for management of water in excavations, or abandonment of wells placed for any long term groundwater monitoring.

4.2 To Be Considered Guidance

In addition to ARARs, guidance was identified in the FS to be used as "to be considered" (TBC) information for the selected remedial alternative. NRC Policy and Guidance Directive FC 83-23 "Termination of Byproduct, Source and Special Nuclear Material Licenses" (NRC 1983) was identified as TBC guidance establishing release criteria for concrete debris and other non-soil materials. NRC Policy and Guidance Directive FC 83-23 establishes limits on surface contamination levels for release for unrestricted use. The residual surface activity limits for ^{232}Th plus its progeny from NRC Policy and Guidance Directive FC 83-23 are:

- 1,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) average over no more than 1 m^2 of area
- 3,000 dpm/100 cm^2 maximum over no more than 100 cm^2 of area
- 200 dpm/100 cm^2 of removable activity

The release criteria for concrete debris or other non-soil materials will be multiplied by 0.6 or by 0.4 to compute allowable alpha and beta activity levels, respectively.

4.3 Remedial Action Objective for the RWDA

RAOs provide goals for protecting human health and the environment and are established based on media-specific contaminants. As discussed in Chapter 5, a Tier I ecological risk assessment did not identify risk to ecological receptors from FUSRAP constituents; however, the human health risk assessment identified risk to a hypothetical future industrial worker in the RWDA from exposure to surface and subsurface soils. Therefore, an RAO was developed to address potential future risk to certain human receptors from exposure to soils. The RAO identified to be appropriate for the RWDA and adjacent boundary areas is as follows:

> *Prevent the external exposure to, and the ingestion and inhalation of residual radioactivity from monazite sand processing (thorium and uranium and their respective decay progeny) present in surface and subsurface soil at the RWDA site so that the total effective dose equivalent (TEDE) to an average member of the critical group does not exceed the benchmark dose standard developed in accordance with 10 CFR 40, Appendix A, Criterion 6(6) and that the design standards for the control of radon and direct gamma exposure in 10 CFR 40, Appendix A, Criterion 6(1) are achieved in those areas where residual radioactivity remains in place.*

4.4 Remedial Goals for Contaminated Media at the RWDA

Within the scope of a FUSRAP response action at a non-Federally-owned property, USACE has the authority to remediate the following eligible contaminants (USACE 2003):

- *Radioactive contamination (primarily uranium and thorium and associated radionuclides) resulting from the Nation's early atomic energy program activities, i.e., related to Manhattan Engineer District (MED) or Atomic Energy Commission (AEC) activities, to include hazardous substances associated with these activities (e.g. chemical separation, purification);*
- *Other radioactive contamination or hazardous substances that are mixed or commingled with contamination from the early atomic energy program activities;*
- *Other substances may be included where directed by Congress.*

The primary FUSRAP COCs at the site include ^{232}Th and its decay progeny. ^{226}Ra and decay progeny will also be considered FUSRAP COCs, but only under the condition that ^{232}Th and decay progeny are commingled and present at elevated levels. As discussed in Chapter 5, unacceptable risks for future human receptors due to exposure to FUSRAP radiological COCs were identified in soils at the RWDA. Therefore, remedial goals have been developed for FUSRAP COCs in soil. No unacceptable risks from FUSRAP COCs were identified for groundwater, surface water, or sediment. The radionuclides in the ^{232}Th series are considered the key FUSRAP-related COCs that will drive the remedial action at the RWDA and boundary areas. Other W.R. Grace processing wastes (i.e., non-FUSRAP wastes) have been disposed in the eastern portion of the facility. These process wastes may include metals (or other chemicals) and naturally occurring radioactive material.

4.4.1 Remedial Goals for Soil

The RGs developed for soil at the RWDA and boundary areas are based on the selected chemical-specific ARAR, which provides standards for radium in soil of 5 picocuries per gram (pCi/g), averaged for surface soils within the first 15 centimeters (cm), and 15 pCi/g within subsurface soils below the first 15 cm. These standards are designed to provide an acceptable level of protection to the average member of a critical group who may be exposed to radium in soil for a given scenario. However, in addition to radium, other radionuclides were identified in the soil as being associated with the monazite processing. Therefore, in accordance with the chemical-specific ARAR, the sum of the ratios calculation (also called the unity rule) must be applied to assure compliance with the benchmark dose associated with the radium standards. The general form of the unity rule is shown below in Equation 1:

$$SOF = 1 \geq \frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \frac{C_3}{DCGL_3} + \frac{C_4}{DCGL_4} ..... + \frac{C_N}{DCGL_N} \quad \text{<Equation 1>}$$

where,

C_N = Measured concentration of a given radionuclide (pCi/g) above background
$DCGL_N$ = Derived Concentration Guideline Level of a given radionuclide (pCi/g)
SOF = Sum of Fractions

As indicated by Equation 1, compliance with the chemical-specific ARAR requires that the sum of the fractions for each radionuclide concentration present will not exceed 1.

To determine a guideline level ($DCGL_N$) for each radionuclide, a benchmark dose was calculated for ^{228}Ra in soil using the Residual Radioactivity (RESRAD, DOE 2005) benchmark modeling software. Where site-specific values for input parameters were not available, the default values provided in RESRAD were used. An Urban Resident scenario was selected as the most appropriate exposure scenario for the RWDA. Although the site is currently used for industrial activities, the chemical-specific ARAR requires calculation of the peak annual TEDE within 1,000 years to the average member of the critical group. Thus, the Urban Resident scenario was selected as the most conservative reasonably foreseeable future residential exposure scenario for the RWDA. The resulting benchmark dose from exposure to ^{228}Ra for an Urban Resident scenario was calculated to be 30.08 millirem per year (mrem/yr) for exposure to surface soil and 39.96 mrem/yr for exposure to subsurface soil. Additional modeling was then conducted using the benchmark dose to calculate the guideline levels for other radionuclides present at the site.

Using RESRAD, DCGL values based on the benchmark doses were calculated for radiological constituents in the ^{232}Th and ^{238}U decay series. Since ^{235}U occurs naturally with ^{238}U (albeit at much lower concentrations), the Actinium Series was also included in the DCGL calculations for completeness. Similar to the benchmark dose assessments, multiple RESRAD simulations were required for indoor and outdoor pathways. In addition, the same site-specific parameters were utilized for calculations.

A total of 11 long lived progeny (half lives greater than 180 days) of the ^{232}Th, ^{238}U, and ^{235}U decay series were included in the RESRAD assessment to calculate DCGL concentrations equivalent to the benchmark doses. The exposure due the short lived progeny is included in the dose and DCGL value for the long lived parent. Since each of the decay series progeny radionuclides are assumed to be in secular equilibrium with their parent, the DCGLs for the 11 individual radionuclides were reduced to decay series fractions (see Table 4-2 below). For each series, a surrogate DCGL was derived based on selection of an equal activity concentration that

resulted in a sum of fractions less than or equal to one. Of note, in accordance with the chemical-specific ARAR, these DCGLs apply to radiological activity above background radionuclide concentrations.

TABLE 4-2: GUIDELINE LEVELS FOR RADIONUCLIDES OF CONCERN IN SOIL

Radionuclide	DCGL (pCi/g)	Equal Activity Concentration (Surrogate DCGL; pCi/g)	Fraction of Limit
Surface Soil			
Th-232	3.51E+02	**4.95E+00**	1.41E-02
Ra-228	1.35E+01	4.95E+00	3.66E-01
Th-228	7.93E+00	4.95E+00	6.24E-01
Thorium Series		Sum of Fractions:	1.00E+00
U-238	4.77E+02	**7.00E+00**	1.47E-02
U-234	3.99E+03	7.00E+00	1.75E-03
Th-230	1.72E+03	7.00E+00	4.08E-03
Ra-226	7.25E+00	7.00E+00	9.65E-01
Pb-210	4.78E+02	7.00E+00	1.46E-02
Uranium Series		Sum of Fractions:	1.00E+00
U-235	1.02E+02	**1.85E+01**	1.82E-01
Pa-231	1.45E+02	1.85E+01	1.27E-01
Ac-227	2.66E+01	1.85E+01	6.95E-01
Actinium Series		Sum of Fractions:	1.00E+00
Subsurface Soil			
Th-232	9.31E+02	**1.48E+01**	1.59E-02
Ra-228	4.32E+01	1.48E+01	3.42E-01
Th-228	2.30E+01	1.48E+01	6.45E-01
Thorium Series		Sum of Fractions:	1.00E+00
U-238	4.06E+03	**4.05E+01**	9.97E-03
U-234	2.78E+04	4.05E+01	1.46E-03
Th-230	4.60E+03	4.05E+01	8.80E-03
Ra-226	4.19E+01	4.05E+01	9.66E-01
Pb-210	2.20E+03	4.05E+01	1.84E-02
Uranium Series		Sum of Fractions:	1.00E+00
U-235	1.03E+03	**1.88E+02**	1.82E-01
Pa-231	1.07E+03	1.88E+02	1.75E-01
Ac-227	2.91E+02	1.88E+02	6.45E-01
Actinium Series		Sum of Fractions:	1.00E+00

Analysis of the activity concentration for each series indicated the following:

- ^{232}Th Series – The surface and subsurface activity concentrations for this series are less than the radium standards required by the chemical-specific ARAR - 10 CFR Part 40 Appendix A, Criterion 6(6). Therefore, these activity concentrations are appropriate surrogate DCGLs for the ^{232}Th Series and will be used to represent the entire series in unity rule calculations.
- ^{238}U Series – The surface and subsurface activity concentrations for this series are greater than the radium standards required by the chemical-specific ARAR. Thus, the limiting values of 5 pCi/g for surface soil and 15 pCi/g for subsurface soil will be used to represent the entire series in unity rule calculations.
- ^{235}U Series – Since ^{235}U occurs naturally at an activity concentration of approximately 1/22 of ^{238}U and the DCGLs for the ^{235}U Series are at least 3 times higher than the limiting ^{226}Ra values, the Actinium Series fraction will always be a small fraction of the total (<0.01). As such, the series dose contribution is considered to be negligible, and it was removed from further DCGL and unity rule analysis.

Based on the analysis of the activity concentrations, and since ^{232}Th is the parent of the thorium decay series and ^{226}Ra is the limiting radionuclide in the uranium series, sum of fractions for surface and subsurface soil at the site are represented as follows:

$$\mathrm{SOF}_{Surface} = 1 \geq \frac{C_{Ra226}}{5\,pCi/g} + \frac{C_{Th232}}{4.95\,pCi/g} \qquad \text{<Equation 2>}$$

$$\mathrm{SOF}_{Subsurface} = 1 \geq \frac{C_{Ra226}}{15\,pCi/g} + \frac{C_{Th232}}{14.8\,pCi/g} \qquad \text{<Equation 3>}$$

In summary, the RG for soil is identified as 1 (i.e., "unity") and represents the sum of the fractions of the total dose contributions from the individual radionuclides of concern that would not exceed the benchmark dose of 30.08 mrem/y for exposure to surface soil and 39.96 mrem/y for exposure to subsurface soil.

4.5 Scope of Remedial Action at the RWDA

The scope of the remedial action at the W.R. Grace Curtis Bay RWDA site is to reduce residual radioactivity in the RWDA and surrounding boundary areas to levels acceptable for a future Urban Resident use scenario in accordance with the ARARs and the established RGs described above. The specific details of the selected remedial action are found in Section 7 of this ROD.

5. SUMMARY OF SITE CHARACTERIZATION

The nature and extent of the FUSRAP COCs are discussed below. Detailed discussions about non-FUSRAP COCs at the site (including pesticides, volatile organic compounds, semi-volatile organic compounds, and metals) are provided in the RI Report (EA 2001).

5.1 Remedial Investigation and Supplemental Sampling Results

USACE conducted a RI at the RWDA from 1999-2001. A gamma walkover survey was performed within the RWDA fence line, and samples from surface and subsurface soil, groundwater, surface water, and sediment were submitted for chemical and radiological analysis. To determine if a radiological constituent was a COC at the site, analytical results were compared to established values. For soil, the established values were cleanup levels for radium isotopes derived from thorium or uranium mill sites in 10 CFR Part 40, Appendix A, Criterion 6(6). These radium limits apply to radionuclide concentrations above background levels. The typical regional background values for soil in this area are approximately 1 pCi/g for ^{232}Th. Groundwater and surface water samples were screened for gross alpha in accordance with 40 CFR sections 141.15 and 141.26, EPA water regulations. These regulations require isotopic radium analysis if gross alpha measurements are greater than 5 pCi/L, and sets a maximum contaminant level (MCL) of 15 pCi/L for gross alpha. Sediment samples were qualitatively evaluated against typical background values and soil screening criteria.

In October 2005, supplemental surveying and sampling activities (soil and concrete) were conducted by USACE to support the RI/FS being conducted for the RWDA (EA 2007). The primary objectives of the work were to evaluate whether FUSRAP-related residual radioactive material was present outside the fenced boundary of the RWDA and to collect sufficient radiological survey and sample data to support FSS design for these areas. Soil sample results were compared to screening criteria based on 10 CFR Part 40, Appendix A, Criterion (6).

Sampling activities conducted during the RI and supplemental sampling events are summarized in Figure 2, including the coverage area of the walkover surveys and locations of soil samples, monitoring wells, surface water samples, and sediment samples.

5.1.1 Surface Soil

Radionuclides in the ^{232}Th and ^{238}U decay series were identified as COCs in surface soil during the RI and supplemental sampling activities at the site.

Remedial Investigation (1999-2001)

The gamma walkover survey conducted at the RWDA during the RI showed evidence of radiological activity above background concentrations based upon a statistical analysis of the survey results. A total of 7.6 acres were surveyed.

A total of 51 surface samples were collected in and around the RWDA, primarily from the 0-2 ft interval, although some samples were collected up to 4 ft below ground surface (bgs). The 4-ft depth corresponds to the 4-ft length of the direct-push soil sample barrel. Radionuclide concentrations above screening criteria were reported in 16 of the 51 surface soil samples collected. While 14 of these 16 locations were inside the fenced area, two sample locations were outside the fenced area to the east of the RWDA. About 20 percent of the surface soil samples were found to have concentrations of ^{232}Th, ^{228}Th, and ^{230}Th above the 5 pCi/g surface soil screening criterion, based on alpha spectroscopy. Similar results were noted for ^{226}Ra, ^{228}Ra, and their decay products determined by gamma spectroscopy.

Supplemental Sampling (2005-2007)

A gamma walkover survey was conducted in the boundary areas of the RWDA, and survey results indicated radiological activity above background based upon a statistical analysis of the survey results. A total of approximately 9.8 acres were surveyed.

Surface soil samples were collected from part of the surveyed area to assess levels of radiological activity. A total of 42 surface soil samples (depth of 0 – 6 in.) were collected and submitted to the laboratory for gamma spectroscopy and isotopic thorium analysis. The soil samples were collected from the berm separating the East and West Spoils Ponds and from the floor of the West Spoils Pond (spoils in the pond were removed by W.R. Grace prior to field activities). Sample results above criteria were reported in the berm due to ^{232}Th (and decay progeny) and ^{238}U decay progeny. The majority of the results for the soil samples collected from the bottom of the West Spoils Pond exceeded criteria due to the concentrations of ^{238}U decay progeny.

5.1.2 Subsurface Soil

Remedial Investigation (1999-2001)

A total of 58 subsurface samples were collected in and around the RWDA to assess levels of radioactivity in subsurface soil. Sample intervals were collected from 2 to72 feet bgs. Radionuclide concentrations above screening criteria were detected in 7 of 58 subsurface soil samples. Only 1 of the 7 samples was located outside the fence line of the RWDA, on the berm

just south of the fence. For subsurface soil sample analyses, between 5 and 12 percent of the samples were characterized by ^{232}Th, ^{228}Th, and ^{230}Th concentrations above 15 pCi/g based on alpha spectroscopy. For ^{226}Ra and ^{228}Ra and their decay products, the result showed that between 5 and 16 percent of the samples have concentrations above 15 pCi/g. These results are based on gamma spectroscopy, and specifically for ^{226}Ra and ^{228}Ra, via radium extraction and analysis by radon emanation and beta counting methods. The subsurface soil exceeding screening criteria ranges in depth from 4 to 25 ft bgs.

Supplemental Sampling (2005-2007)

A total of 22 subsurface soil samples were collected and submitted to the laboratory for gamma spectroscopy and isotopic thorium analysis. The sample collection interval ranged from 1.5 to 17 ft bgs. Results indicated that the soil located within the berm exceeded screening criteria due to ^{232}Th (and decay progeny) and/or ^{238}U decay progeny. One of the eight samples collected in the West Spoils Pond exceeded screening criteria due to ^{238}U decay progeny.

5.1.3 Concrete

During the Supplemental Sampling investigation (2005-2007), a concrete sample was collected from debris observed at the bottom of the Spoils Pond No. 2. The sample was submitted to the laboratory for gamma spectroscopy and isotopic thorium. Concentrations of ^{238}U decay progeny were reported to range from 11.3 – 29 pCi/g. Concentrations of ^{232}Th and decay progeny were reported to range from non-detectable (0.095 pCi/g) to 0.43 pCi/g.

5.1.4 Groundwater

During the RI (1999-2001), groundwater samples were collected, and the following COCs were identified in groundwater:

- Gross alpha
- Gross radium

Gross alpha concentrations greater than the screening level of 5 pCi/L were identified at six monitoring wells in 12 groundwater samples collected at the RWDA. Exceedances by total gross alpha occurred at five wells: GM-8, GM-16, GM-17, MW-2D, and MW-9D. Exceedances by dissolved gross alpha occurred at five wells: GM-8, GM-16, GM-17, and GM-18, and MW-9D. Analyses for radium isotopes (^{226}Ra + ^{228}Ra) at each of the wells listed were conducted. The range of total isotopic radium ranged from 1.8 to 55.5 pCi/L, with a mean of 18.8 pCi/L, while dissolved isotopic radium ranged from 0.71 to 43.32 pCi/L, with a mean of 13.3 pCi/L.

5.1.5 Sediment

During the RI (1999-2001), five surficial sediment samples were collected from Curtis Bay, Herring Pond, and the dredge spoils ponds (which contained spoils at the time of the sampling). Levels of ^{232}Th, ^{238}U, and their decay progeny were noted to be typical of natural rocks and soils. The results indicate that radionuclide concentrations observed in local sediments are not due to the waste present in the RWDA.

5.1.6 Surface Water

During the RI (1999-2001), five surface water samples were collected from Curtis Bay, Herring Pond, and the dredge spoils ponds. One surface water sample was identified as having a gross alpha concentration greater than the screening level of 5 pCi/L. This occurred at surface water sample location SW-1, which was upgradient of the RWDA on the southern side of Spoils Pond 1 (Figure 2). However, based upon the results of sample re-analysis, the radiological levels at that location were considered to be within background. Based on these conclusions, the radiological waste present at the RWDA has minimal to no affect on surface water in the near vicinity of the RWDA.

6. SUMMARY OF SITE RISKS

A Baseline Human Health Risk Assessment (BHHRA) and Tier I Ecological Risk Assessment were conducted as a part of the RI (EA 2001). The following section summarizes the results of the risk assessments for FUSRAP related COCs. For completeness, risks associated with non-FUSRAP constituents are also noted. Results from the supplemental sampling activities (2005-2007) were not included in the risk assessments.

6.1 Baseline Human Health Risk Assessment (2001)

Exposure scenarios evaluated during the BHHRA were current adolescent trespasser, current maintenance worker, future industrial worker, and future construction worker. Lifetime incremental cancer hazards (ca. 1×10^{-3} for the reasonable maximum exposure) for the hypothetical future industrial worker from exposure to radiological dose from FUSRAP COCs in soil were found above acceptable risk levels. The EPA's target risk management range is 1×10^{-6} to 1×10^{-4}. The remaining human health receptors (current adolescent trespasser and maintenance worker, as well as hypothetical future construction worker) had acceptable incremental cancer risks. No unacceptable human health risk from exposure to FUSRAP COCs is identified for surface water or sediments. No unacceptable human health risk from FUSRAP COCs was identified by USACE for groundwater for current or hypothetical future use

scenarios since groundwater is not currently consumed at the site and is not anticipated to be consumed in the future.[3]

USACE found acceptable human health risks for all evaluated receptors for exposure to non-FUSRAP COCs. USACE conducted an additional evaluation to consider combined risk from FUSRAP and non-FUSRAP COCs, which showed that radiological exposure from FUSRAP COCs in soil drives the majority of risk.

6.2 Tier I Ecological Risk Assessment (2001)

There are possible localized risks to ecological receptors from exposure to radiological constituents as evidenced by the maximum screening quotient of 8.09. However, the average radiological screening quotient for ecological receptors across the site (i.e. population risk) is below 1.0; therefore, population level ecological risk from exposure to radiological constituents was determined to be acceptable. USACE noted that there is a high degree of uncertainty associated with calculating ecological risk from radiological exposure.

6.3 Summary of Risks for FUSRAP COCs

The BHHRA, which was conducted with radiological data from the RWDA and adjacent boundary areas, indicates that there are no significant incremental risks associated with current use of the property, given the presence of the existing fencing that the facility uses to limit human access. However, scenarios for reasonably foreseeable future use of the site indicate that there is increased risk for certain future users due to exposure to radiological dose from FUSRAP COCs in surface and subsurface soil. No unacceptable human health risk from exposure to FUSRAP COCs is identified for groundwater for current or hypothetical future use scenarios since groundwater is not currently consumed at the site and is not anticipated to be consumed in the future. USACE identified no unacceptable human health risk from exposure to FUSRAP COCs for surface water or sediments. Based on the ecological risk assessment, USACE determined that the population level ecological risk from exposure to radiological constituents is acceptable.

7. DESCRIPTION OF REMEDIAL ALTERNATIVES

As part of the FS, sampling results from the RI and Supplemental Sampling activities were compared to the RGs to determine whether the area within the RWDA and adjacent boundary

[3] Baltimore City currently provides potable water to the W.R. Grace site. As outlined in the Code of Maryland Regulations (COMAR) 26.03.01.05.A, individual water supply systems cannot be installed if an "adequate" community water supply is available.

areas required remedial action. Portions of the site soils were found to exceed RGs, and remedial action required (Tetrahedron 2008). Areas exceeding RGs are shown on Figure 3.

The six remedial action alternatives for the RWDA identified and evaluated in the FS are as follows:

- Alternative 1 – No Action
- Alternative 2 – Partial Excavation, Off-Site Disposal, Regrading, and Installation of Soil Cap
- Alternative 3 – Regrading and Installation of Soil Cap
- Alternative 4 – Excavation and Off-Site Disposal
- Alternative 5 – Excavation, Segregation, and Off-Site Disposal
- Alternative 6 – Excavation, Segregation, Soil Washing, and Off-Site Disposal

7.1 Alternative 1 – No Action

The NCP and CERCLA require this alternative to be included in order to establish a baseline for comparison with the other alternatives. Under this alternative, no action would be performed to reduce the toxicity, mobility, or volume of residual radioactivity in soil. This alternative does not implement any remedial activity or Land Use Controls (LUCs). In addition, existing controls such as signs and fencing would be discontinued.

7.2 Alternative 2 – Partial Excavation, Off-Site Disposal, Regrading, and Installation of Soil Cap

This alternative includes the excavation and off-site disposal of soil > 3x $SOF_{subsurface}$ (i.e., the most impacted soil), and regrading and consolidation of the remaining soil > $SOF_{subsurface}$ into the central portion of the RWDA, and installation of an engineered soil cap. Debris that does not meet the "soil" Waste Acceptance Criteria will be separated from soil and surveyed for free release using NRC guidance provided in FC 83-23 (NRC 1983) or disposed offsite as debris at an appropriate facility.

Excavation and off-site disposal of soil > 3x $SOF_{subsurface}$ is being conducted to reduce contaminant levels left in place. Soil will be disposed at an appropriate off-site facility permitted or licensed to accept the waste stream depending on the waste characterization. Regrading of soil > $SOF_{subsurface}$ is being conducted to consolidate material in one location and thus improve the design of the engineered soil cap and decrease the complexity of cap inspection and maintenance.

Dewatering activities are expected to be required for this alternative, and extracted water may require treatment prior to discharge/disposal.

Soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil and revegetated in a manner that promotes positive drainage and erosion control. The engineered soil cap will be designed as follows:

- Embankment and cap slopes will be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. In general, slopes should not be steeper than about 5 horizontal to 1 vertical.
- The cap will be designed, to the extent practicable, to limit releases of radon-220 from thorium by-product materials to not exceed an average release rate of 20 picocuries per square meter per second (pCi/m^2s) and to reduce direct gamma exposure from the wastes to background levels.
- Topographic features shall provide good wind protection, promote deposition, and minimize the potential for erosion.
- Once the cap is installed, a self-sustaining vegetative cover will be established or rock cover placed to provide erosion protection.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the "as low as reasonably achievable" (ALARA) component of 10 CFR Part 40, Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted in accordance with the MARSSIM (NRC 2000). Soil survey units (SUs) will be established, and gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

The following LUCs will be implemented to limit exposure to soil and debris that are left in place: (1) fencing and posting will be installed around the capped area and (2) future use restrictions will be implemented to limit the future use of the capped area for the remainder of its life. [4]

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout, as outlined in Article III.C.2.d of *Memorandum of Understanding Between the*

[4] With regard to certain land use controls (LUCs) such as environmental covenants (and similar controls), such controls would not be executed by USACE. Instead, USACE anticipates that the property owner / permittee -- W. R. Grace & Co. -- in conjunction with the state regulators / permitting authority for its facility (MDE) -- would execute such controls.

U.S. Department of Energy and the U.S. Army Corps of Engineers Regarding Program Administration and Execution of the Formerly Utilized Sites Remedial Action Program (FUSRAP), effective 17 March 1999 (USACE 2003). USACE will conduct a 2-year review (prior to transfer to DOE) to document compliance with the RAO at the time of transfer. Following the review and pursuant to agreement between USACE and DOE, the site would be released to DOE to fulfill any long-term surveillance, operation or maintenance responsibilities of the Federal government that are necessary under the selected remedy.

7.3 Alternative 3 – Regrading and Installation of Soil Cap

Alternative 3 includes the regrading/consolidation of soil and debris > $SOF_{subsurface}$ into the central portion of the RWDA, whereupon an engineered soil cap will be installed. There is no off-site disposal component for this alternative.

Regrading of soil > $SOF_{subsurface}$ is being conducted to consolidate material in one location and thus improve the design of the engineered soil cap and decrease the complexity of cap inspection and maintenance.

Dewatering activities are expected to be required for this alternative, and extracted water may require treatment prior to discharge/disposal. The engineered soil cap will be designed as discussed in Alternative 2.

Soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in.) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil and revegetated in a manner that promotes positive drainage and erosion control.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the ALARA component of 10 CFR Part 40, Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted in accordance with MARSSIM (NRC 2000). Soil SUs will be established, and gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

The following LUCs will be implemented to limit exposure to soil and debris that are left in place: (1) fencing and posting will be installed around the capped area and (2) future use restrictions will be implemented to limit the future use of the capped area for the remainder of its life.

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout. USACE will conduct a 2-year review (prior to transfer to DOE) to document compliance with the RAO at the time of transfer. Following the review and pursuant to agreement between USACE and DOE, the site would be released to DOE to fulfill any long-term surveillance, operation or maintenance responsibilities of the Federal government that are necessary under the selected remedy.

7.4 Alternative 4 – Excavation and Off-Site Disposal

Alternative 4 includes the excavation and off-site disposal of surface soils (i.e., top 6 in) that are > $SOF_{surface}$ and all soil > $SOF_{subsurface}$. The soils will be disposed at an appropriate off-site facility permitted or licensed to accept the waste stream depending on the waste characterization. Debris that does not meet the "soil" Waste Acceptance Criteria will be separated from soil and surveyed for free release using NRC guidance provided in FC 83-23 (NRC 1983) or disposed offsite as debris at an appropriate facility.

Dewatering activities are expected to be required for this alternative. Extracted water may require treatment prior to discharge/disposal.

Subsurface soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in.) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil and revegetated in a manner that promotes positive drainage and erosion control.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the ALARA component of 10 CFR Part 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted of the open excavation(s) (prior to backfilling or covering) and surrounding areas in accordance with MARSSIM (NRC 2000). Soil SUs will be established, and gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM

will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout. Since all soils remaining on site will be in compliance with RGs after completion of remedial activities, no site restrictions or long-term monitoring is required. USACE will conduct a 2-year review to document compliance with the RAO and then transfer the site to DOE for site stewardship consisting of records management.

7.5 Alternative 5 – Excavation, Segregation, and Off-Site Disposal

Alternative 5 includes the excavation of soil and debris > $SOF_{subsurface}$, followed by on-site separation of the soil according to its radioactivity (i.e., below and above the $SOF_{subsurface}$). Debris that does not meet the "soil" Waste Acceptance Criteria will be separated from soil and surveyed for free release using NRC guidance provided in FC 83-23 (NRC 1983) or disposed offsite as debris at an appropriate facility.

Segregation can be implemented using traditional sampling/analytical routines or automated (gate) segregation. Segregation technology provides a more complete characterization of the soil, which increases the likeliness of identifying soil that is below RGs. Soil that is identified as being below RGs can be physically separated from the waste stream prior to offsite disposal, increasing the potential to reduce the volume of material requiring disposal.

Dewatering activities are expected to be required for this alternative. Extracted water may require treatment prior to discharge/disposal.

Soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ (including segregated soil) will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil and revegetated in a manner that promotes positive drainage and erosion control.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the ALARA component of 10 CFR Part 40, Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted of the open excavation(s) (prior to backfilling or covering) and surrounding areas in accordance with MARSSIM (NRC 2000). Soil SUs will be established, and

gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout. Since all soils remaining on site will be in compliance with RGs after completion of remedial activities, no site restrictions or long-term monitoring is required, except for the modifications noted in Section 9 of this ROD.[5] USACE will conduct a 2-year review to document compliance with the RAO and then transfer the site to DOE for site stewardship consisting of records management.

7.6 Alternative 6 – Excavation, Segregation, Soil Washing, and Off-Site Disposal

Alternative 6 includes the excavation of soil and debris > $SOF_{subsurface}$ followed by on-site segregation of the soil according to its radioactivity (i.e., below and above the $SOF_{subsurface}$). Once the soil is segregated, the soil > $SOF_{subsurface}$ will be treated using a soil washing technology. Debris that does not meet the "soil" Waste Acceptance Criteria will be separated from soil and surveyed for free release using NRC guidance provided in FC 83-23 (NRC 1983) or disposed offsite as debris at an appropriate facility.

As discussed in Alternative 5, segregation has the potential to reduce the volume of soil requiring off-site disposal through physical partitioning of soil below and above the $SOF_{subsurface}$ RG. Soil washing is being conducted to reduce radiological activity of the soil through treatment, which will further reduce the volume of soil ultimately requiring off-site disposal. After the soil undergoes soil washing, it will be re-segregated according to its radioactivity (i.e., below and above the $SOF_{subsurface}$). Soil that does not meet the subsurface RG and wastes produced during soil washing will be disposed at an appropriate facility permitted or licensed to accept the waste streams, based on waste characterization.

Dewatering activities are expected to be required for this alternative. Extracted water may require treatment prior to discharge/disposal.

[5] Please note that the Responsiveness Summary (Appendix A) includes a comment from the MDE requesting institutional controls be implemented as part of Alternative 5 to ensure the area is not unknowingly disturbed in the future. As this is the USACE-selected alternative, this alternative has been modified, as presented in Section 9, to include institutional controls.

Soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ (including treated soil) will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil and revegetated in a manner that promotes positive drainage and erosion control.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the ALARA component of 10 CFR Part 40, Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted of the open excavation(s) [prior to backfilling or covering] and surrounding areas in accordance with MARSSIM (NRC 2000). Soil SUs will be established, and gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout. Since all soils remaining on site will be in compliance with RGs after completion of remedial activities, no site restrictions or long-term monitoring is required. USACE will conduct a 2-year review to document compliance with the RAO and then transfer the site to DOE for site stewardship consisting of records management.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

8.1 Evaluation Criteria

The following two criteria are threshold criteria that must be met.

- Overall Protectiveness of Human Health and the Environment - The selected alternative must eliminate, reduce, or control threats to public health and the environment through treatment, engineering controls or institutional controls (engineering controls and institutional controls are both types of LUCs.)

- Compliance with ARARs - The selected alternative must meet identified Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or a waiver must be justified.

The following five criteria are balancing criteria.

- Long-Term Effectiveness and Permanence - considers the ability of an alternative to maintain protection of human health and the environment over time once cleanup goals have been met.

- Reduction in Toxicity, Mobility, or Volume through Treatment - evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

- Implementability - considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

- Short-Term Effectiveness - considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

- Cost - considers the estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of plus or minus 50 percent.

The following two criteria are modifying criteria.

- State/Support Agency Acceptance- considers the acceptance of the state or support agency of the preferred alternative.

- Community Acceptance- considers the acceptance of the community of the preferred alternative.

8.2 Alternative Comparison

The alternative comparison was used during the FS process to help select the preferred alternative by rating the alternatives on how they compare to the first seven criteria. A summary of the evaluation is provided in Table 8-1. The results of the evaluation are discussed in the following sections. The two modifying criteria are also discussed below.

8.2.1 Overall Protection of Human Health and the Environment

Alternative 1 does not provide protection for human health and the environment because no action is taken to address the unacceptable risks identified in the baseline risk assessments. Alternative 1 leaves the soil and debris in excess of remediation criteria in the current condition; therefore, external exposure to radioactivity and direct contact to the contamination is not prevented.

TABLE 8-1: SUMMARY OF REMEDIAL ACTION ALTERNATIVES FOR THE RWDA

Alternative	Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness/ Time to Implement	Implementability	Cost (Million) PV
Alternative 1 No Action	Does not meet threshold criteria	No	Does not meet threshold criteria	No	High/Not Applicable	Does not meet threshold criteria	$0
Alternative 2 Partial Excavation and Offsite Disposal, Regrading, and Installation of Soil Cap	Medium	Yes	Medium	No (Includes removal of COCs from the site)	Medium/ 18 months	Medium	$23.5
Alternative 3 Regrading and Installation of Soil Cap	Medium	Yes	Medium	No	Medium/ 18 months	Medium	$10.7
Alternative 4 Excavation and Off-Site Disposal	High	Yes	High	No (Includes removal of COCs from the site)	Medium/ 18 months	High	$37.7
Alternative 5 Excavation, Segregation, and Off-Site Disposal	High	Yes	High	No (Includes removal of COCs from the site)	Medium/ 20 months	High	$29.2
Alternative 6 Excavation, Segregation, Soil Washing and Off-Site Disposal	High	Yes	High	Yes	Low/ 44 months	Medium	$38.6
High is the most favorable rating Low is the least favorable rating							

Alternatives 2, 3, 4, 5 and 6 are protective of human health and the environment. These five alternatives reduce or eliminate exposure to acceptable levels. Alternative 2 excavates and disposes a portion of the soil and debris in excess of the remediation criteria off site and caps and covers the remaining material in place, while Alternative 3 caps and covers materials in excess of the remediation criteria. Institutional and engineering controls are included in Alternatives 2 and 3 to provide protection and control for future use of the site. Since these remedies rely on institutional and engineering controls and an ongoing inspection and maintenance program, uncertainty exists regarding the long-term level of protection.

Alternatives 4, 5, and 6 provide a greater degree of protection for human health and the environment in the long term than Alternatives 2 and 3 because the contamination above RGs is removed from the site. Alternatives 5 and 6 reduce the volume of soil required for offsite disposal.

8.2.2 Compliance With ARARs

There is one chemical-specific ARAR for the FUSRAP COCs at the RWDA - 10 CFR Part 40, Appendix A, Criterion 6(6). Alternative 1 does not comply with the chemical-specific ARAR. All other alternatives comply with the chemical-specific ARAR. The cap installed under Alternative 2 and 3 would meet the design requirements of Criterion 4(a) through (d) and (f) and Criterion 6(1). Alternatives 4, 5, and 6 involve excavation and off-site disposal of all soil and debris above the RGs. Institutional and engineering controls would be implemented for Alternatives 2 and 3 because the alternatives do not allow for unrestricted use.

Location and action-specific ARARs exist for all alternatives except Alternative 1. Specific location- and action-specific ARARs for each alternative are identified in the Feasibility Study. Each alternative would meet the requirements of the location- and action-specific ARARs identified for that alternative.

8.2.3 Long-Term Effectiveness and Permanence

Alternative 1 does not implement any action. Therefore, it does not provide long-term effectiveness and is not permanent. Alternatives 2 and 3 provide long-term effectiveness with the implementation of engineering and institutional controls. Future risk is not completely eliminated because not all of the soil and debris above RGs is removed from the site, and future maintenance and repair is needed to ensure the integrity of the cap and engineering controls. The adequacy and reliability of the cap and site restrictions is considered medium.

Alternatives 4, 5 and 6 provide long-term effectiveness and permanence because the soil and waste above RGs would be removed, segregated, or washed. Residual risk would be acceptable

for unrestricted use. The adequacy and reliability of Alternatives 4, 5, and 6 are considered high.

8.2.4 Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

Alternatives 1 through 5 do not provide any reduction of toxicity, mobility or volume of the waste through treatment. Alternative 6 reduces toxicity and volume of the waste by lowering the concentration of the contaminants through soil washing.

8.2.5 Short-Term Effectiveness

Alternative 1 does not create additional risks to workers or the community because no action is taken. No additional exposure or risk is created as a result.

Short-term impacts to the community and workers are created by Alternatives 2, 3, 4, 5 and 6. These impacts include potential internal and external exposure to radioactivity during material handling and the potential for accidents and spilling of contaminated material during transportation. However, appropriate controls including dust control, environmental monitoring, safety plans, safe equipment, and the use of personal protective equipment and trained personnel would minimize these risks. An additional short-term impact associated with Alternative 6 is increased exposure to radioactivity and exposure to chemicals during soil washing. These impacts would be addressed by collection and treatment of off gases, use of high efficiency particulate air (HEPA) filters, use of personal protective equipment, monitoring, and use of trained personnel.

Short-term impacts to the environment are created by all of the alternatives. Alternative 1 does not implement an action; therefore, the short-term impact to the environment is potential future migration of contamination. Additional short-term impacts to the environment are created by Alternatives 2, 3, 4, 5 and 6. These impacts are associated with wildlife habitat and wetlands disturbance, potential impacts to air quality, and erosion. Dust/fume control and air monitoring would mitigate impacts to air quality. Erosion and sediment controls would be used to prevent surface-runoff and transportation of contamination.

Alternative 1 creates the least amount of potential impacts and, therefore, has the greatest short-term effectiveness. Alternative 3 creates a lesser amount of potential impacts than Alternatives 2, 4, 5, and 6 due to a greater amount of soil handling during implementation of Alternatives 2, 4, 5 and 6. Alternatives 4, 5, and 6 have less potential to impact the environment than Alternative 2.

The estimated time until protection is achieved is 18 months for Alternatives 2, 3, and 4 and 20 months for Alternative 5. For Alternative 6, this time is 44 months. These time estimates do not include the post-remedial operation and maintenance (O&M) activities such as monitoring.

8.2.6 Implementability

The overall implementability of the alternatives is the combined evaluation of the technical and administrative feasibility. The overall implementability of Alternative 1 is considered low. The implementability of Alternatives 2 and 3 are considered medium due to long-term maintenance and monitoring that are required. The implementability of Alternatives 4 and 5 are considered high because these alternatives employ technologies that are proven, reliable, and have been successful at other FUSRAP sites. The implementability of Alternative 6 is considered medium due to the uncertainty regarding the effectiveness of soil washing for the soil at the RWDA.

8.2.7 Cost

No cost is associated with Alternative 1. The estimated present value (PV) costs to complete Alternatives 2 and 3 are significantly less than Alternatives 4, 5, and 6. Alternative 5 costs are lower than Alternative 4 since less soil below RGs is removed from the site and disposed due to utilization of the segregation technology. The highest costs are associated with Alternative 6 due to the high costs associated with soil washing.

8.2.8 State/Support Agency Acceptance

The MDE is the lead State agency for the site, on behalf of and in consultation with the EPA. MDE reviewed the Final PRAP and provided a comment to USACE during the public comment period (see Appendix A). MDE recommended that the preferred alternative identified in the PRAP (Alternative 5) should incorporate institutional controls to prevent inadvertent exposure of individuals who may, at some point in the future, disturb the impacted area of the RWDA. MDE expressed concern that, without the use of appropriate institutional controls, a person conducting excavation at the RWDA in the distant future might inadvertently bring material exceeding surface soil criteria to the surface, or dispose excavated material at an inappropriate facility. After careful consideration of MDE's comment, USACE incorporated the agency's recommendation into the selected alternative for the site, Alternative 5, which is discussed in Section 9.

8.2.9 Community Acceptance

Community acceptance of the preferred alternative was evaluated based on comments received during the public comment period (September 27 to October 27, 2009). All comments were considered, and significant comments were described and addressed in the Responsiveness Summary, which is provided in Appendix A. In general, the public comments support the selection of Alternative 5 as the remedial action for the site.

9. SUMMARY OF THE SELECTED REMEDY

Alternative 5, Excavation, Segregation, and Off-Site Disposal, is the selected remedy for the RWDA site. The selected remedy consists of:

- Excavation of soil and debris materials
- Segregation of excavated material
- Disposal of soil and debris materials > $SOF_{subsurface}$ to an appropriate off-site facility
- Regrading of soil below RGs and placement of a soil cover
- Final Status Survey (FSS)
- Surveillance, operation, and maintenance at the site, if necessary, including 5-Year reviews after site closeout
- Implementation of LUCs, if necessary, based upon an evaluation of as-left conditions during the RA

Alternative 5 includes the excavation of soil and debris > the $SOF_{subsurface}$, followed by on-site separation of the soil according to its radioactivity (i.e., below and above the $SOF_{subsurface}$). Debris that does not meet the "soil" Waste Acceptance Criteria will be separated from soil and surveyed for free release using NRC guidance provided in FC 83-23 (NRC 1983) or disposed offsite as debris at an appropriate facility. Segregation has the potential to reduce the volume[6] of material requiring disposal and can be implemented using traditional sampling/analytical routines or automated (gate) segregation.

Due to the depth of soil and debris > $SOF_{subsurface}$ relative to the groundwater table, dewatering activities are expected to be required for this alternative. Extracted water may require treatment prior to discharge/disposal.

Soil with activity > $SOF_{surface}$ and < $SOF_{subsurface}$ (including segregated soil) will be regraded into the RWDA, and a soil cover (with a minimum depth of 6 in) will be placed over the consolidated soil. Areas of excavation and regrading will be backfilled with clean soil in a manner that promotes positive drainage and revegetated to provide erosion control.

During the remedial design for this alternative, an analysis will be conducted to determine if additional actions are required to address the ALARA component of 10 CFR Part 40,

[6] Segregation provides a more complete characterization of the soil, which increases the likeliness of identifying soil that is below RGs. Soil that is identified below the subsurface RG can be physically separated from the waste stream prior to offsite disposal. Segregation could reduce the waste stream by at least 30%, based upon results obtained at other similar sites.

Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 (NRC 2006) and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted of the open excavation(s) (prior to backfilling or covering) and surrounding areas in accordance with MARSSIM (NRC 2000). Soil SUs will be established, and gamma walkover surveys and systematic grid sampling will be conducted to demonstrate that residual radioactivity levels within each SU meet the remedial goals. The guidance in MARSSIM will be used to the fullest extent practical for subsurface areas that are outside the scope of MARSSIM.

In addition, the FSS contractor will review data collected during the soil segregation and regrading activities. If the data indicates that there is subsurface soil remaining on site with COC concentrations in excess of $SOF_{surface}$, LUCs will be implemented to protect against unknowing or inadvertent exposures of individuals who may, at some point in the future, disturb the subsurface soil remaining in the RWDA. LUCs will be developed in concert with MDE to include an environmental covenant or similar instrument to provide notice of the location of the soil > $SOF_{surface}$ in order to protect against inadvertent exposure to this soil.

USACE is responsible for surveillance, operation, and maintenance at the site for a 2-year period after site closeout. If all soils remaining on site are below $SOF_{surface}$, no site restrictions or long-term monitoring is required. As such, USACE will conduct a 2-year review to document compliance with the RAO and then transfer the site to DOE for site stewardship consisting of records management. If there is an area(s) at the site with subsurface soil in excess of $SOF_{surface}$, then the LUCs developed (as described in the previous paragraph) will be implemented to prevent inadvertent exposure to this soil. USACE will conduct a 2-year review (prior to transfer to DOE) to document compliance with the RAO at the time of transfer. Following the review and pursuant to agreement between USACE and DOE, the site would be released to DOE to fulfill any long-term surveillance, operation or maintenance responsibilities of the Federal government that are necessary under the selected remedy, to include 5-Year Reviews, if LUCs are implemented.

ARARs and TBC guidance for the selected alternative include the following:

- Clean-up Criteria for Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content; 10 CFR Part 40, Appendix A, Criterion 6(6)
- Mitigation of Nontidal Wetlands; COMAR 26.23.04.02 B(1)
- Mitigation of Tidal Wetlands; COMAR 26.24.05.01 B(1)
- Numerical Criteria for Toxic Substances in Surface Water; COMAR 26.08.02.03-2

- Air Emissions Standards for PM; COMAR 26.11.06.03 (D)
- Well Installation and Maintenance; COMAR 26.04.04.07 B, D through L, M(2), and O
- Well Abandonment; COMAR 26.04.04.11 (D)(1), (D)(2)(a)-(b), (E), (F), and (G)
- Residual Surface Activity Limits; NRC Guidance Directive FC 83-23 (NRC 1983)

The ARARs and TBC guidance listed above are discussed in detail in Section 4 and summarized in Table 4-1.

Alternative 5 reduces the risk at the site by removing and disposing soil and debris that is above the $SOF_{subsurface}$ to an appropriate off-site facility. Therefore, long-term protection is provided for human health and the environment. The use of intensive ex-situ analyses and segregation will reduce the volume of material requiring removal and disposal and characterize 100% of the material backfilled on-site. This alternative does not reduce the toxicity, mobility, and volume through treatment. Overall, long-term effectiveness of this alternative is considered high.

Potential short-term impacts to workers, the public, and the environment during construction may include dust generation, external exposure to radioactivity, and disturbance of wildlife, existing habitats and wetlands. Impacted soil and debris will be transported off-site and clean fill brought on site, entailing additional rail and/or truck traffic. The impacts will be addressed by instituting appropriate dust mitigation measures, environmental monitoring for radioactivity, use of personal protective equipment, safety plans, use of trained personnel, erosion and sediment controls to prevent surface-runoff and transportation of contamination, and site restoration. Therefore, overall short-term effectiveness of Alternative 5 is considered to be medium.

Alternative 5 is implementable because the activities will be conducted using standard construction methods. Traditional screening and sampling methods may be used for segregation. Alternatively, the relatively new technology of automated (gate) segregation, which has been used effectively at other sites, may be used here. The number of off-site disposal facilities for radioactive waste is limited, but these facilities are available and being utilized for other FUSRAP projects. Therefore, technical feasibility is considered high.

Segregation and off-site disposal of waste are reliable technologies. The actual TEDE will be calculated with a particularly high level of confidence due to the extensive data set generated through segregation. Therefore, the administrative feasibility is considered high.

The total present value costs for Alternative 5, as outlined in the FS (Tetrahedron 2008), are estimated to be $29,224,872. Table 9-1 shows the cost breakdown by task. The estimated time to complete the cleanup, assuming no funding constraints, is approximately 20 months. It should be

noted that the project costs shall be reviewed and adjusted, as necessary, during preparation of the remedial action design to address budgetary constraints, escalation factors, and remedial design specifications. USACE intends that the selected remedy shall be the final FUSRAP remedial action for the RWDA at the W.R. Grace Curtis Bay Facility.

TABLE 9-1: COST SUMMARY FOR THE SELECTED REMEDY: ALTERNATIVE 5

TASK	COST (PV)
Remedial Design:	$588,282
Remedial Action: Site Clearing and Grubbing Groundwater Extraction Wells Excavation Soil Segregation Media Filtration Carbon Adsorption Regrading Soil Cover Site Cleanup and Landscaping Decontamination Confirmation Sampling Professional Labor	$15,201,319
Transportation and Disposal: Rail Spur Off-Site Transportation and Waste Disposal	$14,160,034
Site Closeout: Site Closeout Documentation Two-Year Review	$59,113
Subtotal	$30,008,748
Escalation Cost	$2,237,913
Total Cost	$32,246,661
Present Value	**$29,224,872**

Notes:

1) Estimated time to completion is 20 months.

2) Tasks and costs above are as identified in the Final Feasibility Study for the RWDA (Tetrahedron 2008). These costs will be reviewed and adjusted, as necessary, during preparation of the remedial action design to address budgetary constraints, escalation factors, and remedial design specifications.

3) Implementation and monitoring of LUCs, if required, is estimated to add approximately $259,000 (PV) to the cost of the selected remedy, which accounts for the costs of establishing and implementing administrative LUCs as well as 5-Year Reviews.

10. STATUTORY DETERMINATIONS

The selected remedy, Alternative 5, satisfies the statutory requirements of Section 121 of CERCLA, which are as follows:

- The remedy must be protective of human health and the environment
- The remedy must attain ARARs or define criteria for invoking a waiver
- The remedy must be cost effective
- The remedy must use permanent solutions and alternative treatment technologies to the maximum extent possible.

The manner in which the selected alternative satisfies each of these requirements is discussed in the following sections.

10.1 Protection of Human Health and the Environment

The selected remedy is fully protective of human health and the environment. Alternative 5 reduces the risk at the site by removing and disposing soil and debris that is above the $SOF_{subsurface}$ to an appropriate off-site facility. This alternative eliminates potential exposure to residual soil exceeding $SOF_{surface}$ by placing this material at depth, adding a soil cover (minimum depth of 6 in.), and implementing LUCs. Therefore, long-term protection is provided for human health and the environment.

During implementation of the remedial action, engineering controls will be put into place as required, and environmental monitoring and surveillance activities will be maintained to ensure that no member of the public will receive radiation doses above guidelines from exposure to residual radioactive material. Dust generation and external exposure to radioactivity are potential short-term impacts to workers and the community due to excavation and segregation activities during the implementation of the selected remedy, and will be mitigated through the use of appropriate controls for dust control and environmental monitoring for radioactivity. Potential risks to workers will be mitigated through the use of personal protective equipment, safety plans, environmental monitoring for radioactivity, and the use of trained personnel. The potential for accidents and spilling of contaminated material associated with the transportation of waste will be mitigated through and the use of safe equipment, trained personnel, and planning. The selected remedy reduces the volume of materials requiring shipment through segregation, further reducing the risks associated with the transportation of waste.

Potential impacts to the environment for the selected remedy include possible disturbance of wildlife habitat due to excavation and possible disturbances of wetlands. Short-term impacts to air quality will be mitigated by the controls used for protection of the community and workers (i.e., dust control). Erosion and sediment controls would be used during implementation to prevent surface-runoff and transportation of contamination.

10.2 Attainment of ARARS

The standards established in the chemical-specific ARAR,10 CFR Part 40, Appendix A, Criterion 6(6), will be attained by performance of the selected remedy. The remedial action involves the removal of materials containing residual AEC-related radioactive contamination. Verification of compliance with soil cleanup standards will be demonstrated using surveys developed in accordance with MARSSIM, or other appropriate guidance. At the completion of the remedial action, radioactivity in soils at the RWDA will be below the guidelines for urban residential use. The selected remedy will also comply with the other pertinent ARARs (i.e., the location- and action-specific ARARs listed in Section 9).

10.3 Cost Effectiveness

Cost effectiveness is evaluated by comparing the individual costs associated with the six alternatives developed for the site and then determining which alternative provides the best balance of the five balancing criteria. The selected remedy, Alternative 5, provides a reasonable balance among the alternatives identified in the FS. Although it has a higher cost compared to Alternatives 2 and 3 (cap-in-place scenarios), it offers higher protection of human health and the environment and provides assurance that a future response action to address long-lived radionuclides will not be required at the site. In addition, it is highly implementable, cost effective compared to Alternatives 4 and 6, removes materials above the subsurface RG from the site, and allows for unrestricted use of the property for a future urban resident. Thus, when all of the balancing criteria are considered, Alternative 5 is a cost effective solution.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Possible

The selected remedy provides a permanent solution to contamination that currently exists at the site, since soil above the subsurface RG will be removed from the site. The segregation technology has the potential to reduce the volume of material requiring disposal and can be implemented using traditional sampling/analytical routines or automated (gate) segregation. The selected remedy achieves reduction of mobility through offsite disposal at an approved landfill.

10.5 Determination Summary

USACE selects Alternative 5 as the remedy for the RWDA. It will achieve substantial risk reduction by removing radioactive soil above RGs from the site. This alternative provides a reasonable balance among the alternatives. It is protective of human health and the environment, complies with environmental regulations, addresses community concern by removing radioactive materials from the site, and allows for continued industrial use of the property as well as future urban residential use. The time and cost to implement the selected remedy are reasonable, and the comments received from the public and state agencies are generally supportive of the selected remedy. None of the comments received favors another alternative over the selected remedy, and USACE has incorporated MDE's recommendation that LUCs be included as part of the selected remedy. If all soils remaining on site are below $SOF_{surface}$, no LUCs or long-term monitoring is required. As such, USACE will conduct a 2-year review to document compliance with the RAO and then transfer the site to DOE for site stewardship consisting of records management. If there is an area(s) at the site with subsurface soil in excess of $SOF_{surface}$, future use restrictions will be implemented to prevent unknowing or inadvertent exposures. USACE will conduct a 2-year review (prior to transfer to DOE) to document compliance with the RAO at the time of transfer. Following the review and pursuant to agreement between USACE and DOE, the site would be released to DOE to fulfill any long-term surveillance, operation or maintenance responsibilities of the Federal government, to include 5-Year Reviews, if LUCs are implemented under the selected remedy.

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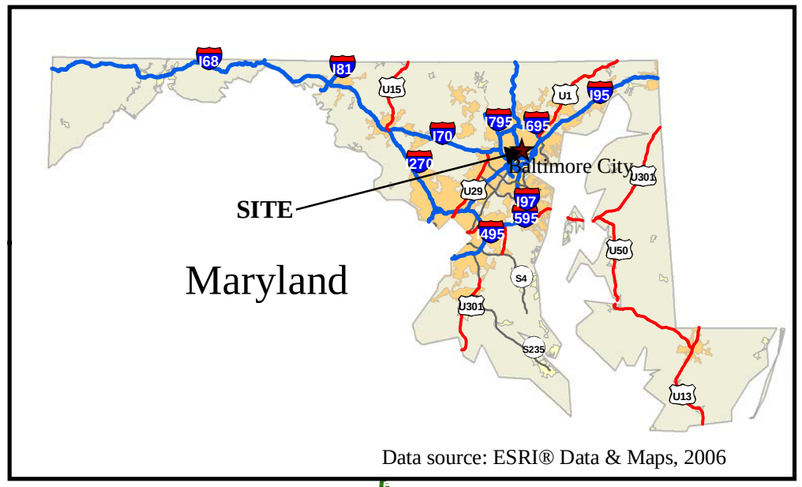
FIGURES



Data source: ESRI® Data & Maps, 2006

CURTIS CREEK

CURTIS BAY

SOUTHWEST QUADRANT (BUILDING 23)

RADIOACTIVE WASTE DISPOSAL AREA RWDA

HERRING POND

EXISTING CAPPED LANDFILL

SLUDGE CAKE CELL

SPOILS POND NO. 2 (WEST)

SPOILS POND NO. 1 (EAST)

Legend

- Capped Landfill
- Waterline
- Boundary
- Paved Road
- Secondary Road
- Building
- Railroad
- Tanks
- Spoils Ponds
- Fence
- Railroad
- Paved Road
- RWDA
- Southwest Quadrant (Building 23)

N

0 400 800

Feet

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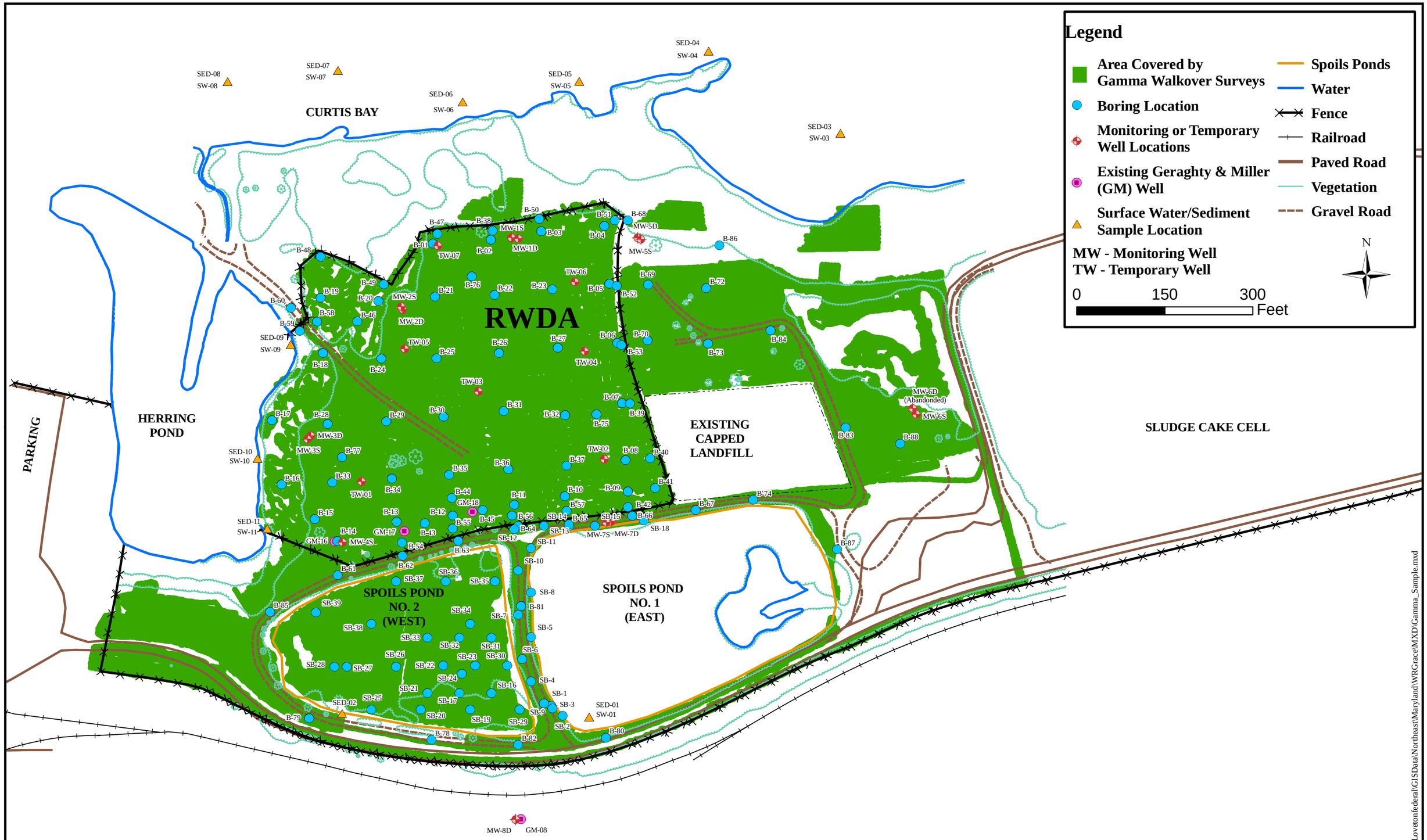
SITE LAYOUT FUSRAP AREAS INVESTIGATED BY USACE

W.R. Grace Curtis Bay Facility
Baltimore, MD

Figure 1



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OVERVIEW OF FUSRAP RI AND SUPPLEMENTAL SAMPLING ACTIVITIES IN THE RWDA AND BOUNDARY AREAS

W.R. Grace Curtis Bay Facility
Baltimore, MD

Figure 2

CURTIS BAY

RWDA

HERRING POND

EXISTING CAPPED LANDFILL

SLUDGE CAKE CELL

PARKING

SPOILS POND NO. 2 (WEST)

SPOILS POND NO. 1 (EAST)

Legend

- Spoils Ponds
- Water
- Fence
- Railroad
- Paved Road
- Vegetation
- Gravel Road
- Exceeds Subsurface RGs
- Exceeds Surface RGs
- May Exceed Surface and/or Subsurface RGs*

*Areas are assumed to be above RGs based upon gamma walkover surveys.

RG = Remedial Goal

0 150 300

Feet

N

\\Lovetonfederal\GISData\Northeast\Maryland\WRGrace\MXD\ExceedsV2.mxd

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OVERVIEW OF AREAS EXCEEDING REMEDIAL GOALS (RGS) IN RWDA AND BOUNDARY AREAS

WR Grace Curtis Bay Facility
Baltimore, MD

Figure 3

APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
RADIOACTIVE WASTE DISPOSAL AREA (RWDA)
BALTIMORE, MARYLAND

This Responsiveness Summary has been prepared for the W.R. Grace RWDA site to summarize the significant comments, criticisms, and new relevant information submitted during the public comment period. This summary includes the responses provided by the U.S. Army Corps of Engineers (USACE) during and after the public meeting.

I. OVERVIEW

The Proposed Remedial Action Plan (PRAP) for the RWDA was issued in September 2009. Public notification of the release of the PRAP and administrative record was issued through a press release to *The Baltimore Sun*, which was published on 27 September 2009. Special interest groups, local residents, and stakeholders received additional notification via letters, which were mailed on 28 and 29 September 2009. The parties receiving letters included community groups, politicians, and regulatory agencies: Community of Curtis Bay Association, Brooklyn and Curtis Bay Coalition, Brooklyn-Curtis Bay Ministerial Alliance, Concerned Citizens for a Better Brooklyn, Baybrook Eco Watch, South Baltimore Community Advisory Panel, City of Baltimore Department of Planning, U.S. Senator Benjamin L. Cardin, U.S. Senator Barbara A. Mikulski, U.S. Congressman Dutch Ruppersberger, Maryland State Senator George W. Della, Jr., Maryland State Delegate Carolyn J. Krysiak, Maryland State Delegate Peter A. Hammen, Maryland State Delegate Brian K. McHale, Baltimore City Mayor Sheila Dixon, the EPA, the MDE, local citizens, the W.R. Grace Curtis Bay Facility, and the Grace Davison Headquarters.

The comment period for the PRAP occurred from 27 September through 27 October 2009. A public meeting was held on 7 October 2009. At this meeting, the public was given the opportunity to ask questions and to comment on the remedial alternatives for the site outlined in the PRAP, as well as the preferred alternative that was recommended by USACE. The public generally supported USACE's preferred alternative to address the residual radiological activity at the RWDA site. A summary of the public meeting is included in Appendix B of this ROD.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

The USACE developed a Community Relations Plan in August 2001 to develop the methodology for informing the public of the W.R. Grace Curtis Bay Facility RWDA site and for soliciting comments and concerns regarding site activities. In addition, repositories for site information

were established within the surrounding community (Brooklyn Branch Library) and at the USACE office in Baltimore City. The repositories were updated in a timely manner in order to provide documentation of site activities to the public.

The USACE has attended meetings with Maryland regulators and the South Baltimore Community Advisory Panel (a local community group) to provide information about the site and address any concerns regarding planned activities. The public meeting was held to discuss the PRAP and solicit feedback. Based upon the attendance at meetings, the level of community interest in the site is characterized as low. Residents have responded favorably to site remediation.

III. SUMMARY OF SIGNIFICANT COMMENTS AND QUESTIONS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND USACE RESPONSES

This section provides a summary of the significant oral and written comments received during the public comment period and USACE's responses to them. The oral comments were made at the public meeting that was held 7 October 2009. A summary of the public meeting is included in Appendix B. Written comments received during the comment period from September 27 through October 27, 2009 are included at the end of this section. Some comments have been taken out of context; therefore, clarification, if necessary, has been added to the responses (shown in italics).

Comments Received during the Public Meeting

1: Did sampling during site investigation activities include sampling of the existing capped landfill adjacent to the RWDA?

Response: The existing capped landfill was not sampled during the RI or supplemental sampling activities. The lined landfill was closed under and is maintained in compliance with MDE's requirements. Records of the landfill content are available. The landfill does not contain FUSRAP waste associated with monazite sand processing conducted under contract to the AEC. It was not feasible to sample the soil beneath the lined landfill during the site investigation activities; therefore, it is unknown whether FUSRAP waste may be buried beneath the lined landfill. During the remedial action, excavation of the area adjacent to the landfill will allow for better characterization of the soil in that area. At that point, USACE will assess whether any action is required for soil underneath the existing landfill.

2: Over the years, were workers at the W.R. Grace Curtis Bay Facility made aware of the presence of these materials?

Response: Information about the RWDA was not kept from W.R. Grace employees, but the information may not necessarily have been posted. Employees that had need to go into the area were informed of the potential risks and were involved with the surveys that were conducted to determine if there was a risk to employees. During previous investigations, both EPA and the Maryland Department of the Environment determined the site did not pose an imminent threat that needed to be addressed.

3: Are the ponds at the W.R. Grace Curtis Bay Facility influenced by tides?

Response: The ponds (Spoils Pond Nos. 1 and 2) are not tidally influenced. The levels of ^{232}Th and ^{238}U found in surface sediment samples obtained during the RI from Curtis Bay, the Spoils Ponds (which contained spoils at the time), and Herring Pond are typical of natural rocks and soils. Radionuclide concentrations in all surface water samples were within background.

4: Is the Maryland Department of the Environment (MDE) involved in this project?

Response: MDE has been kept informed of developments for the RWDA site, and their input has been requested throughout the project.

5: Will W.R. Grace help pay for the remedial action?

Response: As agreed upon in a settlement between the United States and W.R. Grace, W.R. Grace is responsible for 40 percent of cleanup costs for FUSRAP contamination associated with monazite sand processing conducted under contract to the AEC, and the federal government is responsible for the remaining 60 percent.

6: Will the property be able to be used after the remedial action?

Response: During the Public Meeting, it was stated that USACE supports cleanup of the RWDA to levels that would allow for future use of the site. Under the proposed remedy, Alternative 5, the RWDA will be cleaned up to levels that would permit future residential use. However, the RWDA is located in an industrial area, and it will be used for industrial purposes in the foreseeable future.

It was further stated that other remedial alternatives considered as part of the FS would place greater restrictions on future use of the site. Alternative 1, which specifies no action, would potentially limit activities that could safely be performed on the site. Alternatives 2 and 3 would require future use restriction, because material above the RGs would remain onsite. *USACE would like to clarify this response by noting that while LUCs will be implemented under Alternative 5 if soils above* $SOF_{surface}$ *remain on site, this alternative is still considered to be more permissive of a variety of future site uses, included possible residential use, than Alternatives 2 and 3.*

7: Could a future use of the property by W.R. Grace result in new contamination, and what are the company's plans for the site after the remedial action?

Response: Since the property is owned by W.R. Grace, USACE can't control the future use of the property. However, current environmental regulations are much more comprehensive than those existing at the time of the monazite sand processing during the 1950s, and W.R. Grace would have to apply for the appropriate permits for any new activities once remediation of the RWDA is complete.

8: Will air quality be impacted during the remedial action? What are the potential hazards, related to air quality, during the proposed action? Who is responsible for monitoring air quality during remediation?

Response: Air monitoring will be conducted and engineering controls will be implemented, as necessary, during the remedial action to protect the health of workers and the public from any particulates that could become airborne during site activities. Air

samples will be evaluated on site and results will be compared to strict federal standards. In the event that standards are not being met, work at the site will stop until the problem can be remedied.

The contractor performing the remedial work will have the primary responsibility for implementing an air quality monitoring and control program. However, USACE will have a quality assurance role in ensuring that air quality standards are met and may elect to perform their own monitoring. MDE may also provide additional oversight of the site activities and has the ability to stop work.

9: If there is a problem or issue related to the remedial action, who is responsible?

Response: USACE is the lead federal agency for the remedial action. However, depending on the nature of the problem or issue, W.R. Grace, the remedial action contractor, or another entity may be held responsible.

10: Is there data on facilities that are impacted with similar constituents as the RWDA?

Response: Yes, there are other sites in the FUSRAP program that were impacted in a similar fashion as a result of activities conducted under contract to the AEC. [Note: Information on such sites is publicly available on the World Wide Web.]

11: How long will it take to remove radioactive material from the site?

Response: The estimated timeframe for completion of Alternative 5 is 20 months, assuming that no delays occur due to funding constraints.

12: What is the acceptable risk range used to assess risk to human health?

Response: The target range for risk defined by the USEPA is an incremental cancer risk of 1×10^{-4} to 1×10^{-6}.

13: Has groundwater been affected by radioactive materials, and could it impact nearby surface water?

Response: At the Public Meeting, it was stated that some groundwater samples collected during the RI and supplemental sampling activities did contain detectable levels of radionuclides. However, surface water and sediments collected from the ponds and from Curtis Bay did not contain detectable levels of radionuclides. Thus, there is no indication that radiological constituents at the RWDA are affecting nearby surface water. *USACE would like to clarify this response by noting that potable water service is provided by the City of Baltimore. Groundwater beneath the site is not used by W.R. Grace.*

14: The proposed plan mentions that "appropriate vegetation" will be planted once the soil excavation and regrading is complete. What type of vegetation will be planted?

Response: USACE expects to follow the guidelines of the Baltimore City Critical Area Management Program in selecting appropriate vegetation for the RWDA site after the soil excavation and regrading is completed.

15: Are there wetlands on the site?

Response: During the Public Meeting, it was stated that there are wetlands in the RWDA, but they were created as a result of regrading and are not native wetlands. At the time of the Meeting, it was mistakenly stated that such wetlands did not meet the criteria for wetlands. *USACE would like to correct the response given during the Public Meeting. As part of the RI process EA was scoped to identify/delineate wetlands in and around the RWDA. During the RI, tidal wetlands were identified north of the RWDA fence line, and non-tidal anthropogenic wetlands were identified within the RWDA fence line and east of the RWDA in the adjacent boundary area. The preferred remedial alternative addresses soil contamination in and around the RWDA fence line. Given the location of the contaminants, both the non-tidal and tidal wetlands will likely be impacted as a result of remedial activities conducted at the RWDA. Action-specific ARARs have been identified for actions conducted in wetlands, which require that steps be taken to avoid*

adversely impacting wetlands and that mitigation be performed if alteration or destruction of the wetlands cannot be avoided. The Action-Specific ARARs governing actions conducted in tidal and nontidal wetlands are COMAR 26.24.05.01 B(1) and COMAR 26.23.04.02 B(1), respectively. Given the initial identification of wetlands during the RI, these ARARs are applicable to the site. The length of time since delineation has been over 10 years; however, these ARARs are applicable to the site to the extent that the presence of wetlands is verified at the time of the remedial action (i.e. although no changes are expected, the presence of wetlands will need to be verified by the RA contractor at the time of the remedial action in accordance with typical procedures). Whether the wetlands are native or anthropogenic is immaterial; the restrictions specified in the ARARs apply in either case.

16: A community member expressed a preference for transporting materials offsite by railcar rather than by truck.

Response: USACE agrees that transport by railcar is often a preferable alternative over transport by truck, and will strongly consider the use of railcar transport during development of the remedial design.

Comments Provided by Stakeholders Outside the Public Meeting

The following comment was submitted by Harold L. Dye, Jr., Administrator, Hazardous Waste Program, Maryland Department of the Environment, in an email message on October 27, 2009:

The Maryland Department of the Environment, Hazardous Waste Program, wishes to offer the following comment on the U. S. Army Corps of Engineers (USACE), Baltimore District Proposed Remedial Action Plan (PRAP) for the Radioactive Waste Disposal Area (RWDA) at the W.R. Grace Curtis Bay Facility, Baltimore, Maryland. The site is subject to remediation under the U.S. Government's Formerly Utilized Sites Remedial Action Program (FUSRAP). The PRAP was the subject of a public meeting on Wednesday, October 7, 2009, at the Curtis Bay Recreation Center in Baltimore, Maryland.

In the Proposed Remedial Action Plan, the Corps of Engineers identifies alternative 5 as its preferred alternative. One of the elements of this alternative is that surface soils with radiological activity that exceeds a surface exposure criterion would be regraded into the RWDA and then covered with a minimum 6 inch soil cover.

The Hazardous Waste Program believes that the alternative should incorporate some form of institutional control to protect against unknowing or inadvertent exposures of individuals who may, at some point in the future, disturb the waste remaining in the disposal area. The institutional control must be designed so that there is a permanent record of the nature of the material that will remain in the RWDA. The institutional control must also provide that the record of the nature of the remaining material will be readily discovered by or disclosed to individuals who could potentially disturb the RWDA.

A major concern we have is that, in the absence of an appropriate institutional control, a contractor doing excavation on the site in the distant future would be unaware of the presence of the contaminated subsurface material, and this could result in buried material that exceeds the criterion for surface exposure being left on the surface or removed for disposal elsewhere in an inappropriate place. The viability of the Corps of Engineers' preferred alternative is predicated on there being no material at the surface that exceeds a surface exposure criterion. That could be easily compromised unless there is a clear record delineating where potentially problematic material remains buried, with that record being administered in such a way that anyone contemplating disturbing the ground is made aware of the situation.

Response: USACE recognizes MDE's concern about ensuring that the established surface soil criterion is not exceeded. During the remedial action, the FSS contractor will review data collected during the soil segregation and regrading activities. If the data indicates that there is subsurface soil remaining on site with COC concentrations in excess of $SOF_{surface}$, LUCs, to include an environmental covenant or similar instrument, will be implemented to provide notice of the location of the soil > $SOF_{surface}$ in order to protect against unknowing or inadvertent exposures of individuals who may, at some point in the future, disturb this soil remaining in the disposal area. LUCs will be developed in concert with MDE. This requirement has been incorporated into Section 9 (Summary of the Selected Remedy) and Section 10 (Statutory Determinations) of this ROD.

APPENDIX B

PUBLIC MEETING SUMMARY (7 OCTOBER 2009)

U.S. ARMY CORPS OF ENGINEERS, BALTIMORE DISTRICT
FORMERLY UTILIZED SITE REMEDIAL ACTION PROGRAM

PUBLIC MEETING ON PROPOSED REMEDIAL ACTION PLAN
FOR THE
W.R. GRACE RADIOACTIVE WASTE DISPOSAL AREA

OCTOBER 7, 2009
BALTIMORE, MARYLAND

The following is a summary of a public meeting held on Wednesday, October 7, 2009 at the Curtis Bay Community Center, Baltimore, Maryland.

POSTER SESSION

The meeting opened at 6:00 p.m. with a poster session. Community members had the opportunity to view posters describing the site history, summarizing the work completed to date, and outlining the Proposed Remedial Action Plan. Staff from the U.S. Army Corps of Engineers and EA Engineering were available to give an overview of the project and answer questions. Community members were given the opportunity to have their comments entered into the record.

No community members entered comments into the record during the poster session.

PRESENTATION

At 7:00 p.m., Ms. Nicki Fatherly of the U.S. Army Corps of Engineers opened the formal portion of the meeting. She welcomed everyone and expressed her appreciation for everyone taking the time to attend. She explained the purpose of the meeting was to discuss the Formerly Utilized Site Remedial Action Program (FUSRAP) Site, the Radioactive Waste Disposal Area, located on the W.R. Grace property at Curtis Bay. Ms. Fatherly stated she had about a 40-minute presentation to explain what is occurring with the site and why they are seeking the community's input.

Ms. Fatherly introduced herself as the Project Manager for the Corps of Engineers, Baltimore District. She then introduced several other team members who would be participating in the presentation. She introduced Mike O'Neill of EA Engineering, a contractor for the Corps, and stated he will be discussing what was done during the investigation. She introduced John Beckman and stated he will be talking about the Feasibility Study and the different techniques and ways to formulate and remediate the problem, as well as talking about what the Corps believes is the best alternative for the area. Ms. Fatherly suggested questions be held to the end of the presentation as later parts of the presentation may answer the question. She offered to explain any unfamiliar acronyms. Ms. Fatherly stated the meeting was being recorded so

any questions or comments could be officially entered into the record. She advised she and other staff members would also be available after the meeting to answer questions.

Ms. Fatherly explained that the project was at the point in the process where the Corps proposes what alternative it would like to implement to remediate the site. She continued explaining that part of the process is holding a public meeting and a 30-day public comment period which is underway. She explained the meeting and comment period had been advertised in the Baltimore Sun on September 28 and comments would be accepted through October 27. She said later in her presentation she would explain the various methods for providing comments both at the meeting and after the meeting.

Ms. Fatherly showed a photo of the site and explained it is located at the W.R. Grace Curtis Bay Facility on Curtis Point. She advised the manner in which work has been performed follows the CERCLA [Comprehensive Environmental Response, Compensation and Liability Act] process which consists of a step-by-step process including the remedial investigation which Mr. O'Neill will be discussing and the feasibility study which Mr. Beckman will be discussing.

Ms. Fatherly stated in 1956, under a contract with the Atomic Energy Commission, a process with monazite sand was performed at the site to extract radioactive elements (thorium and uranium) for use as part of the stockpile during the post atomic age. She advised the processing occurred for about 18 months into 1957. Ms. Fatherly explained there are two parts to the property. She stated a public meeting had been held a few years ago on the part of the building where the processing occurred, and a remedy selected for that part of the site. She explained tonight's meeting focused on the other part of the site, where after the sand was processed in the building on the main part of the site, this area was where waste was buried according to directions by the Atomic Energy Commission in place at that time for properly disposing of these elements.

Ms. Fatherly stated that in the 1980s the site was placed in the FUSRAP program. She continued explaining that as part of the program, an investigation is required to decide what to do with the radioactive material based on today's standards. She added that the Baltimore Corps of Engineers is responsible for this program locally.

Ms. Fatherly displayed a flow chart showing the CERCLA process. She mentioned CERCLA is sometimes referred to as Superfund but emphasized this site is not a Superfund site. She stated the flow chart is representative of the orderly, rigorous process that has been employed which leads to a decision about remediation of the site.

Ms. Fatherly stated the reason for the meeting is to present the alternative the Corps believes is best for this area, and provide a summary of all the background and activities that helped Corps arrive at the recommendation of the preferred alternative.

Ms. Fatherly then turned over the presentation to Mr. Mike O'Neill.

Mr. O'Neill stated that numerous investigations have been conducted at the site from 1978 through 1995. He said in 1978 W.R. Grace contracted for a walkover survey to confirm the presence of radiological material. Mr. O'Neill noted that in 1979 the Department of Energy was made aware of conditions at the site, and they contracted for an aerial radiological survey which confirmed a radiological signature was coming from the Radioactive Waste Disposal Area. He advised the Department of Energy also contracted for a walkover survey at that time to confirm the surface and site conditions and concluded residual radioactive material was present. Mr. O'Neill stated in 1982, the U.S. Environmental Protection Agency and Maryland Department of the Environment became aware of the site, and both agencies conducted surveys of the facility to assess the extent of contamination at the site. He noted the agencies were basically interested in surface conditions, possible runoff, general facility conditions, and any changes since the last survey to make sure no additional material had been placed at the site.

Mr. O'Neill said in 1984 the site was accepted into the FUSRAP program based upon the information collected by the Department of Energy. He advised in 1990, the Department of Energy did a paper study trying to determine the volume of material present so that they could project future costs and complete additional investigations. Mr. O'Neill stated that in 1999, W.R. Grace conducted a survey to assess conditions and installed a fence around the disposal area.

Mr. O'Neill next discussed the remedial investigation performed by the Corps of Engineers as part of the CERCLA process to determine the nature and extent of the contamination. He displayed a list of tasks conducted under the remedial investigation which included surface radiological surveys; geophysical surveys to determine if there were burial trenches or other buried items at the site; a topographic survey; a habitat assessment; wetland delineation; vegetation sampling; monitoring well sampling; soil/groundwater/sediment/surface water sampling and analysis for chemical and radiological constituents and TCLP [Toxicity Characteristic Leaching Procedure]; and, downhole gamma logging which was done to provide additional data, along with the surface radiological scans and the soil samples, to get a complete picture of what was buried in the area. Mr. O'Neill explained all the data was used to prepare a baseline human health risk assessment and an ecological risk assessment. Mr. O'Neill indicated the sample locations on a map. He stated the majority of the sampling was done within the fenced area, with some samples collected outside as well as surface water and sediment samples.

Mr. O'Neill reviewed the remedial investigation results which confirmed the presence of residual radioactive material. He stated the human health risk assessment found no risk under the current uses of the facility. He noted for certain potential future uses, including future industrial workers, there would be a need to take remedial action for the surface and sub-surface soil. Mr. O'Neill advised the ecological risk assessment did not show any risk to ecological receptors from the FUSRAP constituents. Mr. O'Neill said because of the potential future risk, the site advanced to the Feasibility Study step.

Mr. O'Neill stated that a supplemental sampling event was conducted in 2005 to address some data gaps with respect to the boundary areas outside of the fenced area. He explained surface radiological surveys were performed, along with sampling of surface and subsurface soil and concrete debris, and additional downhole gamma logging was conducted to gather additional data and obtain better cleanup cost estimates in the Feasibility Study. Mr. O'Neill showed a map of the area where the supplemental sampling was conducted within the Spoils Ponds and boundary of the site. Mr. O'Neill said results from the supplemental sampling showed residual radioactive material was present in the boundary area.

Mr. O'Neill referred to a map of the site and stated the green shaded area denoted the gamma walkover surveys performed as part of the remedial investigation and supplemental investigation. He said all of the area was covered by the survey to determine the surface radiological activity, and along with the extensive sampling program, to gather enough data to calculate the cost to cleanup the site.

Mr. O'Neill turned the presentation over to Mr. John Beckman, a health physicist with the Corps of Engineers, to discuss the Feasibility Study.

Mr. Beckman stated the Feasibility Study was conducted in 2008 and the Applicable or Relevant and Appropriate Requirements (ARARs) were identified during this study. He explained these are Federal regulations that would be appropriate to determine the cleanup activities for this site. He said the Feasibility Study also developed preliminary remedial goals, identified the areas for remediation, developed the remedial alternatives, and compared the alternatives. Mr. Beckman noted the Feasibility Study also identified the chemical-specific Applicable or Relevant and Appropriate Requirements as set forth in the Code of Federal Regulations, 10 CFR 40 Appendix A Criterion 6(6). He explained this provided guidance on how to deal with the cleanup and follow proper regulations to clean up the site. He noted the Federal regulation is relevant, and the best fit to address the radiological material remaining at the site. He advised the preliminary remedial goals were developed based on the selected ARAR. Mr. Beckman said the remedial investigation and supplemental sampling results were compared to the preliminary remedial goals to find out which areas of the site exceeded the preliminary remedial goals.

Mr. Beckman showed a diagram of the area and stated the historical study and compilation of the sampling data found elevated areas at the disposal site above the preliminary remedial goals. He pointed out the location of an additional elevated area, and some areas where the levels are near the preliminary remedial goals and which are going to be included as part of the action.

A community member asked if the sampling included the capped landfill, and Mr. Beckman responded that the landfill was not impacted. Mr. Hans Honerlah from the Corps added that records exist as to what was placed in the landfill; what may be a question is what was below the landfill. He stated as the remediation proceeds, an assessment will be done to determine if it is appropriate to remove material that may be

below the landfill or if the removal would create a greater risk than leaving the material in place.

Mr. Beckman stated the Feasibility Study followed CERCLA guidance and developed six remedial alternatives. He advised "no action" is always included as an alternative, while the other alternatives ranged from partial excavation and regrading to complete excavation and off-site disposal of various amounts of material.

Mr. Beckman displayed a list of the criteria used to evaluate the alternatives. He stated the threshold criteria are overall protectiveness of human health and the environment and compliance with ARARs. He stated these are the main criteria, and if an alternative fails to meet these criteria, a new alternative is needed. He said the next group of criteria includes long-term and short-term effectiveness; reduction in toxicity, mobility or volume through treatment; implementability; and weighing different costs. He explained the modifying criteria are State and community acceptance and are why the meeting is being held. He said the meeting provides the community the opportunity to look at the alternatives, provide suggestions, and voice any concerns.

Mr. Beckman reviewed a chart showing a comparative analysis of alternatives. He stated Alternative 1, no action, failed to meet the threshold criteria so it was deleted from further consideration. He advised other alternatives met the threshold criteria, with alternatives four through six best meeting all criteria. He noted cost for each alternative was also considered.

Mr. Beckman explained after the selection of alternatives, a Proposed Plan is developed and a Record of Decision. He stated after the public comment period, the final decision will be announced in public documents and then the Corps will proceed with that decision.

Mr. Beckman reviewed the contents of the Proposed Remedial Action Plan, noting it included the history of the site, a summary of the six alternatives, and identification of the Corps' preferred alternative, which is Alternative 5: Excavation, Segregation and Off-Site Disposal.

Mr. Beckman discussed the preferred alternative noting it involved excavation of soil and removal of materials above the preliminary remedial goals. He stated material which does not exceed the preliminary remedial goals will be placed in the bottom of the excavated area, and then a clean soil berm will cover the site and erosion control measures put in place. Mr. Beckman advised the segregation method will also reduce the waste volume and reduce the cost to taxpayers.

Mr. Beckman said the alternative includes protection of workers and the public. He stated protection of human health and environment is important. He said during the excavation a radiation safety program will be implemented which will include extensive radiation surveys, air monitors at the perimeter which will monitor particulates for radioactive isotopes, and procedures where if dust is generated, the area will be sprayed

with water to control the dust. Mr. Beckman said the Corps of Engineers will provide oversight of the contractor, and W.R. Grace will have oversight of operations at the facility while the work is being performed.

Mr. Beckman stated waste would be shipped out to a permitted facility approved for disposal and noted there are several such facilities out West. He said the shipment will be by truck or rail, with a preference for rail. He noted all shipments will meet Department of Transportation and State shipping requirements. He estimated 60,000 tons of material will be removed.

Mr. Beckman turned the presentation back over to Ms. Fatherly.

Ms. Fatherly summarized the presentation by stating the location of the residual radioactive contamination is known, the Corps has a good idea where the boundaries are, what is above an acceptable level, and what is below an acceptable level. She stated this information was used to go through the Feasibility Study process, weighing the pros and cons of different technologies and methods and taking a broad-breadth look at everything that could be done at the site, from no action to what potentially could be removing every single speck. She said the alternative being suggested, Alternative 5, helps balance the need to reduce risks, especially future risks, and the desire to do so in a cost-effective manner by being able to go in and take out material with the highest levels and leave material with the lower levels in place.

Ms. Fatherly said Alternative 5 is the one the Corps is looking at which involves some excavation, some keeping on site, and then re-grading the site, vegetating it, and from then on W.R. Grace continues to operate their business.

Ms. Fatherly said as part of the public meeting, the Corps is looking for public comment, inquiry or questions. She explained there are various ways to officially or unofficially ask questions. She stated as the project moves to the next step of developing the Record of Decision, many more details will be fleshed out regarding the design of the action. She advised any official comments received during the public comment period, will be entered into the record and answered. She stated questions could also be asked informally. She advised comment cards were available which could be taken home and sent in later; comments were welcome by e-mail, or comments could be made tonight. Ms. Fatherly said hard copies of the Proposed Plan were available on the back table and a copy was also posted on the Corps' web site at http://usace.eaest.com. She advised a copy is also available for review at the Enoch Pratt Free Library, along with the Administrative Record, which is the back up for all the details of the project and recommendation of Alternative 5 as the preferred alternative, including the sampling and data and the Feasibility Study.

Ms. Fatherly thanked everyone for listening to the presentation and opened the floor for questions and comments.

QUESTIONS AND COMMENTS

A community member asked if over the years W.R. Grace employees had been made aware of the site conditions. Mr. Honerlah responded that his understanding is that information was not kept from the employees, but the information was not necessarily posted. He stated employees that had need to go into the area were informed of the potential risks and were involved with the surveys that were conducted to determine if there was a risk to employees. He stated both EPA and the Maryland Department of the Environment determined the site did not pose an imminent threat that needed to be addressed.

A community member asked if the RWDA was within the Critical Area. Ms. Fatherly verified that it was within the Critical Area.

A community member asked if the ponds were tidally influenced, and Mr. Honerlah responded they were not. Mr. O'Neill added that the ponds were sampled, and it was determined there was no impact to the ponds from the radiological material.

A community member asked if the Maryland Department of the Environment was involved with the project. Ms. Fatherly stated they were kept informed and their input requested throughout the project. Ms. Fatherly also mentioned that letters were recently sent to community members about the public meeting and that a notice was published in the paper. She stated there had also been and will continue to be coordination with the citizen advisory board and the community action council.

A community member asked if the cost of the action would be shared by W.R. Grace. Ms. Fatherly advised there was an agreement between the government and W.R. Grace settling liability responsibility for the entire site, with 60 percent of the costs falling to the government and 40 percent to W.R. Grace.

A community member asked if the property will be able to be used in the future and if there is a possibility a future use by W.R. Grace would result in additional environmental contamination. Mr. Honerlah responded that the property will most likely be able to be re-used depending on the alternative selected. He stated the "no action" alternative would potentially limit activities. He explained for the preferred Alternative 5, a model was done using an urban resident and an industrial worker and after implementation of Alternative 5, the results showed the property can be re- used. He added the ultimate goal is to allow the property to be re-used. Mr. Honerlah said the future use of the property is not entirely under the control of the government as W.R. Grace is the property owner. He stated there are many environmental regulations in place now as compared to 50 years ago, and certain future uses of the property would require W.R. Grace to go through current permitting processes which includes government review.

A community member asked if anyone was present from W.R. Grace to comment on future use of the property. A representative from W.R. Grace stated the company has no plans to do anything with the property.

A community member asked about any air quality issues or potential hazards during the excavation and what protective measures will be taken. Mr. Honerlah responded that as the material is excavated, both employees at the work site and the perimeter of the site will have air monitoring. He explained the analysis of the air particulates collected will be done on-site to determine if engineering controls are effective to ensure there is no release to the public. He continued explaining that the project will be complying with the specific standards set by EPA. Ms. Fatherly added that these protective measures are taken very seriously by the Corps as it reflects directly on the Corps capabilities for handling projects of this nature. Mr. O'Neill added that there will be redundant systems in the work area, and if one indicates a problem, the work will stop for re-evaluation. A community member asked who conducts the monitoring. Mr. Honerlah stated the contractor hired by the Corps. He stated they will develop and implement a quality control program, and the government will have a quality assurance role to ensure the data is appropriate and may potentially collect their own data for comparison. He added that the Maryland Department of the Environment also has the ability to look at data and can stop the work. Mr. Honerlah said they will also be working with the property owner to coordinate with their operations.

A community member asked about the Corps' liability for the work versus W.R. Grace. Ms. Fatherly responded that the work is being conducted by the Corps, but depending on the nature of an issue, there could be discussions between the Corps and W.R. Grace. Mr. Honerlah added that the contractor performing the work for the Corps will also have certain liabilities and will have appropriate insurance coverage and permits in place.

A community member asked if data existed for similar type facilities. Mr. Honerlah responded that the Department of Energy has data bases as there are many similar sites which were impacted by the early Atomic Energy Commission. He said the number was in the hundreds. He said the same is true within the Department of Defense, where there are many military sites across the country that have been impacted and are being addressed by the military.

A community member asked how long it would take to remove the material, and Mr. Honerlah responded Alternative 5 was estimated to take about 20 months.

A community member expressed a preference for moving the materials by railcar versus truck, and Mr. Honerlah said rail transportation will be looked at closely and most likely will also be less expensive.

A community member asked for clarification on the acceptable risk range for cancer. Mr. Honerlah explained that EPA's guidance defines an acceptable risk range as $1E^{-4}$ or 1 in 10,000 to $1E^{-6}$ or 1 in 1,000,000 excess cancers. He stated following this guidance, cleanup criteria are developed so material left behind would not create a risk that exceeded this range.

A community member asked if the groundwater wells showed any radioactivity and expressed concern about groundwater from the site impacting nearby surface water. Mr. Honerlah responded that sampling has not shown the radiological material has become soluble. He added that the material is not like solvents which can travel with the groundwater, but is a heavy metal which stays contained in the area buried. In response to a question regarding pH levels, Mr. Honerlah responded that the levels vary but are not impacting the materials. Mr. O'Neill added that sediment and surface water sampling also found no detections. A community member asked if white suits and masks were worn during the sampling. Mr. O'Neill responded that the white suits were worn to keep workers protected from ticks, and masks were not needed.

A community member again expressed concern about the contents of the capped landfill. Mr. Honerlah reiterated that the material in the landfill did not come from the RWDA. He stated he was not concerned with what was in the landfill; however, what was under the landfill is not known. Mr. Honerlah said this issue will be addressed when the field work gets to the toe of the landfill.

A community member asked what type of appropriate vegetation would be planted, and Mr. Honerlah responded that the Corps will work with the CAMP [Critical Area Management Program] to determine compatible vegetation.

A community member asked if wetlands were present, and Mr. O'Neill responded that the current wetlands in the RWDA were created as a result of regrading and are not native wetlands so they did not meet the criteria for wetlands.

After confirming there were no additional questions or comments, Ms. Fatherly adjourned the formal portion of the meeting at 8:05 p.m. She invited community members to continue to review posters and ask questions.

Staff remained at the community center until 9:00 p.m.

Submitted by,

Katrina A. Harris

Katrina A. Harris
Meeting Recorder