PROPOSED REMEDIAL ACTION PLAN

W.R. GRACE CURTIS BAY FACILITY
BALTIMORE, MARYLAND
RADIOACTIVE WASTE DISPOSAL AREA (RWDA)

*This Proposed Remedial Action Plan (**PRAP**) was prepared to satisfy Section 117 (a) of the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA**). This PRAP explains the history of the W.R. Grace Radioactive Waste Disposal Area (**RWDA**) as well as the type and extent of radiological contamination found at the site. The primary purpose of this PRAP is to summarize the six remedial alternatives evaluated for the RWDA and to identify the preferred alternative selected by the Baltimore District of the U.S. Army Corps of Engineers (**USACE-Baltimore**). Consistent with Section 117 (a) of CERCLA, USACE–Baltimore, the Maryland Department of the Environment (**MDE**) encourages the public to participate in the development of the cleanup plan for the RWDA. Public comment is invited on all of the alternatives identified in this PRAP. Information on how to participate in this decision-making process is presented at the end of this plan. Words and acronyms shown in **bold** lettering are defined in the Glossary attached to this plan.*

1. INTRODUCTION AND PURPOSE

USACE–Baltimore, in consultation with MDE**,** is proposing a remedy to address the threat to the health of potential future human receptors created by the presence of residual radioactivity in the RWDA at the W. R. Grace, Curtis Bay Facility (Figure 1). In the 1950s, W. R. Grace processed **monazite sand** at the facility to extract the radioactive element thorium under a contract with the Atomic Energy Commission (**AEC**). Waste materials from the processing operation were disposed in the RWDA, which is located in the non-manufacturing portion of the facility. As a result, residual radioactivity remains in soils in the RWDA and adjacent boundary areas. USACE-Baltimore has performed investigations at the RWDA and will perform or confirm the performance of a remedial action at the RWDA under the Formerly Utilized Sites Remedial Action Program (**FUSRAP**).

This PRAP includes:

- Background information on the RWDA developed during previous investigations (Section 2)
- A summary of risks (Section 3)
- Scope and role of the action (Section 4)
- A discussion of feasible remedial methods and alternatives (Sections 5 and 6)
- The rationale for recommending the preferred alternative (Section 7)
- Opportunities for public participation (Section 8), and
- A glossary.

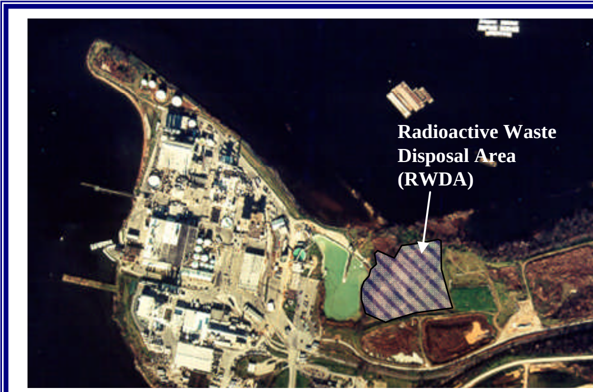

Figure 1. W.R.Grace Curtis Bay Facility Aerial View

This PRAP summarizes information that can be found in greater detail in the Remedial Investigation (**RI**) and Feasibility Study (**FS**) reports for the RWDA as well as other documents available to the public in the designated document repositories. The location of the document repositories and information on how to participate in the decision-making process are included at the end of this PRAP. USACE-Baltimore will finalize the remedy selection for the RWDA in a Record of Decision (**ROD**) after evaluating comments received from the public and consulting with MDE and the U.S. Environmental Protection Agency (EPA).

2. SITE BACKGROUND

Site Description and History

The W. R. Grace Curtis Bay facility is located at 5500 Chemical Road in Baltimore, Maryland. The facility presently occupies 109.7 acres on an industrialized peninsula between Curtis Creek and Curtis Bay in southern Baltimore City (Figure 2). 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 spoil sludge cells, and to the west of a filter cake disposal cell.

From mid-May 1956 to the spring of 1957, W. R. Grace, under contract to the AEC, processed monazite sand in the southwest quadrant of a five-story building (Building 23) in the manufacturing portion of the facility. The products of the monazite processing were reported to be crude thorium hydroxide and rare earth sodium sulfate. Radiological components of monazite sand include uranium-238 (^{238}U) and thorium-232 (^{232}Th) and their decay **progeny**. As a byproduct of the monazite processing operations, waste material termed "**gangue**" was produced. 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. This material was placed in the RWDA. The developmental processing system had operational difficulties, and processing ceased in late spring 1957.

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. At the time of the burial, AEC did not have regulations prohibiting disposal of the gangue in the RWDA. The RWDA also contains general waste including

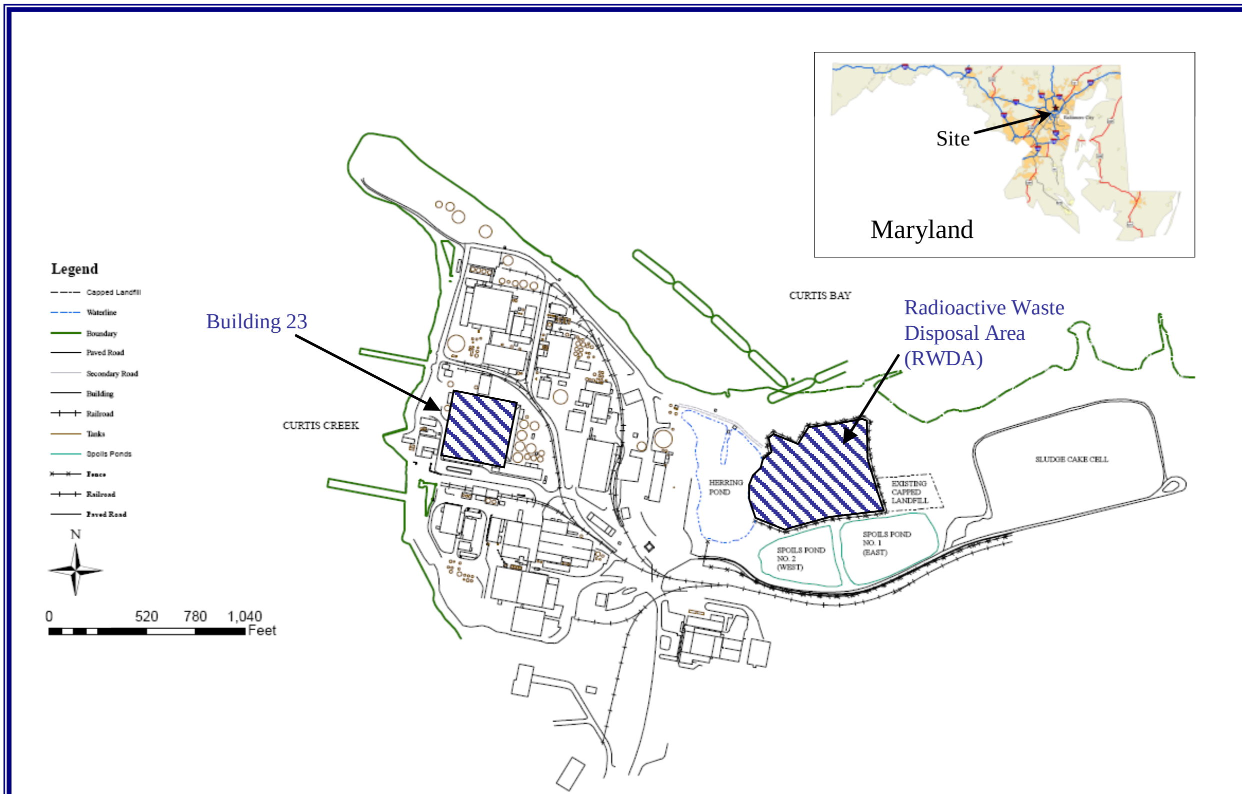

Figure 2. W.R. Grace Curtis Bay Facility Site Plan

rock, refuse (glass, paper, wood, and metal), and dredge spoils. Radioactive waste was believed to be buried at various depths up to 9 ft, but may be as deep as 25 ft. As a result of the processing/disposal activities associated with the monazite processing under contract to the AEC, soils in the RWDA became impacted by radionuclides. The W.R. Grace site was identified for inclusion in FUSRAP in 1984, and the RWDA is the subject of this PRAP. Building 23 is currently being addressed as a separate FUSRAP response action.

In 1995, W.R. Grace installed a fence around the area believed, at that time, to encompass the RWDA. The RWDA is no longer actively used, and W.R. Grace limits access to this area.

Site Characteristics

In 1999/2000, USACE–Baltimore conducted a RI of the RWDA. The intent of the RI was to identify the nature and extent of residual radioactivity at the RWDA due to the monazite sand processing.

A **gamma walkover survey** was performed within the RWDA fence line, and environmental samples were collected from surface and subsurface soil, groundwater, surface water, and sediment and submitted for chemical and radiological analysis. The RI identified FUSRAP-related contaminants (thorium, uranium and their decay progeny) as constituents of potential concern (**COPCs**) at levels above **background** in surface and subsurface soils and groundwater.

In October 2005, supplemental surveying and sampling activities were conducted by USACE to support the RI/FS being conducted for the RWDA. The primary objectives of the work were to evaluate whether FUSRAP-related COPCs 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. The supplemental activities identified FUSRAP-related COPCs above background in surface and subsurface soils in boundary areas outside of the RWDA fence line. These areas, which are discussed in detail in the FS, are included in the scope of the remedial action for the RWDA.

3. SUMMARY OF SITE RISKS

A Baseline Human Health Risk Assessment (**BHHRA**) and Tier I Ecological Risk Assessment were prepared as a part of the RI for the RWDA to evaluate the radiation exposures and risks that could occur to members of the general public and ecological receptors if the RWDA were released in its current condition.

HOW IS RISK CALCULATED?

The human health risk assessment estimates the "baseline risk," which is an estimate of the likelihood of health problems occurring if no cleanup action is taken at a site. The steps used to analyze these risks consist of a four-step process:

(l) data evaluation
(2) exposure assessment
(3) toxicity assessment
(4) risk characterization

In the data evaluation step, relevant site data are compiled to characterize the constituents of potential concern (COPCs). During the exposure assessment step, actual or potential COPC release pathways are analyzed, potentially exposed human populations and exposure pathways are identified, COPC concentrations at potential points of human exposure are determined, and COPC intakes are estimated. In the toxicity assessment step, qualitative and quantitative toxicity data for each COPC are identified, and appropriate guidance levels for risk characterization are identified. Next the likelihood and magnitude of adverse health risks are estimated in the risk characterization step which is measured in the form of excess lifetime cancer risks.

Based on EPA guidance, the upper end of the acceptable risk range can be interpreted as "on the order of 1×10^{-4}."

Risk coefficients for radiogenic cancer morbidity per unit intake (for inhalation and ingestion) and per unit time-integrated activity concentration (for external exposure) were taken from EPA's Federal Guidance Report No. 13, 'Cancer Risk Coefficients for Environmental Exposure to Radionuclides'.

Baseline Human Health Risk Assessment

The objective of the BHHRA was to derive site-specific estimates of the radiation exposures and risks to people who may occupy the RWDA without cleanup or constraints with respect to radiological issues.

Exposure scenarios evaluated during the BHHRA were current adolescent trespasser, current maintenance worker, hypothetical future industrial worker, and hypothetical future construction worker. For each scenario examined, the analysis assessed exposures that could occur by the following three pathways:

- External exposure from radioactivity in surface and subsurface soils.
- Inhalation of dust contaminated with COPCs that may become airborne.
- Inadvertent ingestion of soil contaminated with COPCs.

Risk was calculated following EPA guidance, as discussed in the RI report. Lifetime incremental cancer hazards for the "hypothetical" future industrial worker from exposure to radiological **dose** from FUSRAP COPCs in soil were found to be above acceptable risk levels. Specifically, the calculated risk for reasonable maximum exposure was 1.23 x 10^{-3}. The EPA's target risk management range is 1 x 10^{-6} to 1 x 10^{-4}. The remaining human health receptors examined (current adolescent trespasser, current maintenance worker, and hypothetical future construction worker) had acceptable incremental cancer risks.

No unacceptable human health risk from FUSRAP COPCs 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. Baltimore City currently provides potable water to the W.R. Grace site. As provided by 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.

Tier I Ecological Risk Assessment

There are potential localized risks to **ecological receptors** from exposure to radiological constituents in soils. 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 is acceptable.

Summary and Conclusions

Based on the sampling results and future human health risk associated with the RWDA, it is the USACE's current judgement that active measures are necessary to protect public health or welfare from actual or threatened releases of hazardous substances into the environment. Specifically, unacceptable risks for plausible future human receptors due to exposure to FUSRAP radiological COPCs were identified in soils at the RWDA. Thus a response action is proposed for soil at the site. Preliminary Remedial Goals (**PRGs**) for FUSRAP COPCs in soil have been developed and are discussed in Section 4.

4. SCOPE AND ROLE OF THE RESPONSE ACTION

The proposed response action is expected to meet the **Remedial Action Objective** (RAO) and to be the final FUSRAP action for the RWDA.

Remedial Action Objective

The RAO for the RWDA 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.*

Radionuclides of Concern

The radionuclides of concern at the RWDA, as identified in the RI/FS, 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.

Preliminary Remedial Goals for Soil

The PRGs necessary to complete the RAO were identified and developed for soil during the FS process. The PRGs, which were developed using modeling software known as **RESRAD**, were based on the selected chemical-specific Applicable or Relevant and Appropriate Requirement (**ARAR**), 10 CFR 40, Appendix A, Criterion 6(6), which specifies that,

> *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).*

This standard is designed to provide an acceptable level of protection to the average member of a critical group who may be exposed to radium in soil (above background concentrations) for a given scenario. Since the monazite sand processing was conducted for thorium source material (^{232}Th), benchmark doses were derived (using RESRAD) for ^{228}Ra in surface and subsurface soils. In addition, a 1,000 year time span was included in the RESRAD calculations, as required by the ARAR.

Currently, the site is being used for industrial activities. However, since a 1,000 year time span needed to be considered, a conservative residential scenario (Urban Resident Scenario) was selected as a reasonable future use scenario and was used to model exposure at the site during derivation of benchmark doses.

Since other radionuclides in the ^{232}Th and ^{238}U decay series were identified in the RWDA soil as being associated with the monazite sand processing, a second derivation was performed in order to comply with the unity rule specified in the ARAR. Specifically, Derived Concentration Guideline Levels (**DCGLs**) were derived equal to the benchmark dose for each radionuclide in the ^{232}Th and ^{238}U decay series, for both surface and subsurface soils. After incorporating simplifying assumptions during derivation, the following equations are used to determine compliance with the ARAR:

Surface Soils

$$\mathrm{SOF}_{Surface} = 1 \geq \frac{C_{Ra226}}{5\,pCi/g} + \frac{C_{Th232}}{4.95\,pCi/g}$$

Subsurface Soils

$$\mathrm{SOF}_{Subsurface} = 1 \geq \frac{C_{Ra226}}{15\,pCi/g} + \frac{C_{Th232}}{14.8\,pCi/g}$$

Where,

SOF = Sum of Fractions and

C = Radionuclide concentration (above background levels)

In summary, the PRGs for surface and subsurface soil are identified as 1 (i.e., "unity"), which represents the sum of the fractions of the total dose contributions from the individual radionuclides of concern that would not exceed the surface and subsurface benchmark doses associated with the Urban Resident critical group. A detailed explanation of the methodology used to develop benchmark doses and DCGLs is provided in Appendix A of the FS.

Preliminary Remedial Goals for Groundwater, Surface Water, and Sediment

No unacceptable risks for FUSRAP constituents in groundwater, surface water, and sediment were identified in the RI. Therefore, PRGs were not developed for these media.

5. SUMMARY OF REMEDIAL ALTERNATIVES

This section presents a summary of the remedial action alternatives developed for the RWDA to meet the RAO. A detailed analysis, conducted in accordance with EPA's guidance for conducting an RI/FS under CERCLA and the **National Contingency Plan** (NCP) and as presented in the FS, is also included below.

The six remedial alternatives developed for the soils designated for remedial action at the RWDA include:

- No Action
- Partial Excavation, Off-Site Disposal, Regrading, and Installation of Soil Cap
- Regrading and Installation of Soil Cap
- Excavation and Off-Site Disposal
- Excavation, Segregation, and Off-Site Disposal
- Excavation, Segregation, Soil Washing, and Off-Site Disposal

A summary discussion of each alternative, with estimated **cost** in present value (**PV**) and construction timeframe, is included below. Of note, throughout the discussions, "soil" is used to encompass "soil and soil-like material" that can be excavated, handled, and/or transported and disposed as soil. Additional detail can be found in the FS.

Alternative 1: No Action
Estimated Cost (PV): $ 0
Estimated Construction Timeframe: None

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 soils. This alternative does not implement **land use controls** or any other activity. In addition, existing controls (such as fencing and use restrictions) would not be required at the site.

Alternative 2: Partial Excavation, Off-Site Disposal, Regrading, and Installation of Soil Cap
Estimated Cost (PV): $ 23,500,000
Estimated Construction Timeframe: 18 months

This alternative includes the excavation and off-site disposal of soil > 3x $SOF_{subsurface}$, 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 Nuclear Regulatory Commission (**NRC**) guidance provided in FC 83-23 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 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with U.S. Nuclear Regulatory Commission (NRC) guidance provided in Nuclear Regulatory Commission Regulation (NUREG)-1757 and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (**MARSSIM**). Soil survey units (**SU**s) 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 land use controls 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, as outlined in Article III.C.2.d of *Memorandum of Understanding Between the 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 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.

Alternative 3: Regrading and Installation of Soil Cap

Estimated Cost (PV): $ 10,700,000
Estimated Construction Timeframe: 18 months

Alternative 3 includes the regrading/consolidation of soil and debris > than the $SOF_{subsurface}$ 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 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 and will be updated, as needed, based on actual construction conditions.

A FSS will be conducted in accordance with MARSSIM. 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 land use controls 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.

Alternative 4: Excavation and Off-Site Disposal
Estimated Cost (PV): $ 37,700,000
Estimated Construction Timeframe: 18 months

Alternative 4 includes the excavation and off-site disposal of surface soils (i.e., top six inches) that are above $SOF_{surface}$ and all soil above $SOF_{subsurface}$. 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 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 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 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. 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 PRGs 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.

Alternative 5: Excavation, Segregation, and Off-Site Disposal
Estimated Cost (PV): $ 29,200,000
Estimated Construction Timeframe: 20 months

Alternative 5 includes the excavation of soil and debris greater than 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 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 PRGs. Soil that is identified as being below PRGs 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 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 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. 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 PRGs 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.

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

Estimated Cost (PV): $ 38,600,000

Estimated Construction Timeframe: 44 months

Alternative 6 includes the excavation of soil and debris greater than the $SOF_{subsurface}$ 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 above $SOF_{subsurface}$ 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 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 $SOF_{subsurface}$. 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 PRG 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.

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 40 Appendix A, Criterion 6(6). The ALARA analysis will be developed in accordance with NRC guidance provided in NUREG-1757 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. 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 PRGs 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.

6. EVALUATION OF ALTERNATIVES

The NCP outlines the approach for comparing remedial alternatives. Evaluation of the alternatives uses "threshold," "primary balancing," and "modifying" criteria. Any alternative that does not meet the threshold criteria may not be given further consideration. All alternatives meeting the threshold criteria are evaluated against primary balancing criteria, which are technical criteria based on environmental protection, cost, and engineering feasibility. The primary balancing criteria are used to determine which alternative provides the best combination of attributes. The modifying criteria are applied at the end of the process. No Action is retained to serve as a baseline for comparison of the alternatives. A table summarizing the alternatives with regards to the NCP criteria is provided at the end of this section.

Threshold Criteria

Overall Protection of Human Health and the Environment

All of the alternatives, except the "No Action" alternative, under certain hypothetical exposure scenarios would protect human health and the environment by eliminating, reducing, or controlling risk through either removal, treatment, and/or land use controls. Nevertheless the "No Action" alternative is retained as a baseline consistent with the NCP and CERCLA.

Compliance With ARARs and TBC Guidance

There is one chemical-specific ARAR for the FUSRAP COPCs at the RWDA - 10 CFR 40, Appendix A, Criterion 6(6). Alternative 1 does not comply with the chemical-specific ARAR. All other alternatives comply with the ARAR.

The engineered soil cap installed under Alternatives 2 and 3 would meet the design requirements of 10 CFR 40, Appendix A, Criterion 4(a) through (d) and (f), and Criterion 6(1). Land use controls would be implemented for Alternatives 2 and 3 because the alternatives do not allow for unrestricted use.

Other location and action-specific ARARs and to be considered (**TBC**) guidance have been identified for the site, including:

- Debris will be separated from soil and surveyed for free release in accordance with TBC guidance FC 83-23.
- Soil washing activities will comply with hazardous waste management requirements outlined in COMAR 26.13.05.10.
- Wells for dewatering will be installed and maintained in accordance with COMAR 26.04.04.07 B, D through L, M(2), and O, and abandoned in accordance with COMAR

26.04.04.11(D)(1), (D)(2)(a)-(b), (E), (F), and (G).

- Water generated during dewatering activities will be discharged in accordance with criteria outlined in COMAR 26.08.02.03-2.
- Site activities will comply with requirements for air emissions (COMAR 26.11.06.03(A), (B)(2), (C), and (D)).
- All attempts will be made to avoid and minimize destruction of wetlands in accordance with COMAR 26.23.04.02 B(1) and COMAR 26.24.05.01 B(1).

Except for Alternative 1, each alternative meets the requirements of the location- and action-specific ARARs identified for that alternative.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative 1 does not implement any action and, therefore, it does not provide long-term effectiveness and is not permanent. Alternatives 2 and 3 provide long-term effectiveness with the implementation of land use controls. Future risk is not completely eliminated because not all of the soil and debris above clean-up criteria 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 (the terms "high", "medium", and "low" are used in this section to help rate the alternatives, with "high" being the most favorable and "low" being the least favorable.).

Alternatives 4, 5 and 6 provide long-term effectiveness and permanence because soil and debris not achieving clean-up criteria would be removed and disposed off site. Upon completion of the remedial action, residual risk would be acceptable for unrestricted use. The adequacy and reliability of Alternatives 4, 5, and 6 are considered high.

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. Alternatives 2, 4 and 5 include removal of COPCs from the site. Alternative 6 reduces toxicity and volume of waste through treatment by lowering the contaminant concentrations in soil during soil washing.

SUMMARY OF NCP EVALUATION CRITERIA

Threshold criteria:

Overall Protectiveness of Human Health and the Environment--alternative must eliminate, reduce, or control threats to public health and the environment.

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

Primary balancing criteria:

Long-term Effectiveness and Permanence- considers the ability of an alternative to maintain protection of human health and the environment over time.

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- includes 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.

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.

Short-Term Effectiveness

Alternative 1 does not create additional exposure or risks to workers or the community because no action is taken. 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 chemicals during soil washing. These impacts would be addressed by collection and treatment of off gases, use of HEPA filters, use of PPE, 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 exposure of individuals, as outlined in the hypothetical exposure scenarios. Additional potential 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 and potential impacts to air quality, and erosion. Dust/fume control and air monitoring would mitigate impacts to air quality. Erosion and sediment controls would help to prevent surface-runoff and transportation of contamination.

Implementability

The overall implementability of the alternatives is the combined evaluation of the technical and **administrative feasibility**. The implementability of Alternatives 2 and 3 are considered medium due to long-term maintenance and monitoring that are required for an engineered cap. The implementability of Alternatives 4 and 5 are considered high because the alternatives employ excavation, disposal, and segregation technologies that are proven, reliable, and have been used successfully at other FUSRAP sites. The implementability of Alternative 6 is considered medium due to the uncertainty regarding the effectiveness of soil washing at the site.

Cost

The estimated PV costs and timeframes 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 PRGs 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.

Modifying Criteria

State/Support Agency Acceptance

MDE is the State support and regulatory agency. MDE’s comments will be formally evaluated during the public review and comment period for this PRAP.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated based on comments received during the public comment period. All comments will be considered, and significant comments will be described and responded to in the Record of Decision (**ROD**) that presents the selected remedial alternative. In light of the comments received, USACE-Baltimore may change a component of the preferred alternative, select another alternative, or select a “new” remedy. If the basic features of the new remedy are significantly different from what could have been reasonably anticipated from this PRAP, USACE-Baltimore will seek additional public comment on a revised PRAP.

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 COPCs 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 COPCs from the site)	Medium/ 18 months	High	$37.7
Alternative 5 Excavation, Segregation, and Off-Site Disposal	High	Yes	High	No (Includes removal of COPCs 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							

7. SUMMARY OF THE PREFERRED ALTERNATIVE

The preferred alternative is Alternative 5 "Excavation, Segregation, and Off-site Disposal". This alternative complies with the chemical-specific ARAR for the site. In addition, this alternative meets the requirements of the location- and action-specific ARARs that have been identified. Potential short-term risk during cleanup would be minimized by appropriate protective measures. This alternative would pose no potential long-term impacts to the environment.

PV costs for Alternative 5 are estimated at $29,200,000. The estimated time to complete the cleanup, assuming no funding constraints, is approximately 20 months. Of note, the time to complete this (or any) alternative is dependent on USACE funding, which is appropriated annually from Congress. If the project can be completed sooner, overall costs are likely to be less. Conversely, if the schedule is extended, overall costs are likely to be more. A more detailed schedule and cost estimate will be developed as a part of the remedial design phase of the action.

The preferred alternative (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 the very long-lived radionuclides will not be required at the site. In addition, it is highly implementable, cost effective compared to Alternatives 4 and 6, addresses community concern by removing materials above PRGs from the site, and allows for unrestricted use of the property for a future urban resident. All of these factors make Alternative 5 a superior choice to the other alternatives presented in the FS.

8. COMMUNITY ROLE IN THE SELECTION PROCESS

USACE–Baltimore provides information regarding the cleanup of the RWDA at the W. R. Grace Curtis Bay Facility to the public through public meetings, the Administrative Record File for the site, and announcements that will be published in local papers. USACE-Baltimore encourages public input to ensure that the remedy selected for the RWDA meets the needs of the local community, in addition to being an effective technical solution to the problem.

Although Alternative 5 "Excavation, Segregation, and Off-site Disposal" is the preferred alternative for the site, USACE-Baltimore specifically invites comments from the community and other interested parties not only on the preferred alternative, but the acceptability of all the alternatives identified in the FS. Public comments that support an alternative other than the preferred action, or that suggest effectiveness or efficiency improvements to a presented alternative, will weigh heavily in the final selection process. Therefore, USACE strongly encourages public comment concerning all the alternatives presented in this PRAP.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided in the box to the right.

At the public meeting, the results of the RI and FS will be presented along with a summary of the preferred remedy. After the presentation, a question-and-answer period will be held, during which the public can submit verbal or written comments on the PRAP.

Comments will be summarized and responses provided in the responsiveness summary section of the ROD. The ROD will be the official record of USACE–Baltimore's final selection of the remedy for this site.

PUBLIC COMMENT PERIOD
September 28, 2009 – October 27, 2009

PUBLIC MEETING
To be held on October 7, 2009 at Curtis Bay Recreation Center, 1630 Filbert St., Baltimore, Maryland

ADMINISTRATIVE RECORD FILE / DOCUMENT REPOSITORIES:

1. U.S. Army Corps of Engineers, Baltimore District
   City Crescent Building,
   10 South Howard Street
   Baltimore, Maryland 21201
   Attn: Mr. Clemens Gaines
   (410) 962-2809
   Clemens.W.Gaines@usace.army.mil

2. Enoch Pratt Free Library
   Brooklyn Branch
   300 East Patapsco Avenue
   Baltimore, Maryland 21225
   (410) 396-1120

FOR FURTHER INFORMATION CONTACT:

Nicki Fatherly
Project Manager
U.S. Army Corps of Engineers, Baltimore District
City Crescent Building
10 South Howard Street
Baltimore, Maryland 21201
(410) 962-3542
Nicki.Fatherly@usace.army.mil

Administrative Feasibility—The ability to obtain permits or approval to perform activities associated with the technology utilized.

AEC—Atomic Energy Commission, (a no longer existing federal agency whose responsibilities have been redistributed to DOE and NRC).

ALARA—As Low As Reasonably Achievable**—**means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 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 improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations

ARARs—Applicable or relevant and appropriate requirements**—**The Federal (or State, if more stringent and timely identified by the State) environmental and siting laws that an eligible alternative must meet (or exceed). These requirements may vary among sites and alternatives.

Background—Natural radiation or radioactive material in the environment including: primordial radionuclides (such as ^{40}K, ^{87}Rb, and those belonging to the three radioactive decay series headed by ^{238}U, ^{235}U, ^{232}Th), cosmogenic radionuclides, or cosmic radiation. Naturally occurring radioactive material that has been technologically enhanced is not considered background for purposes of this standard.

BHHRA—**Baseline Human Health Risk Assessment**—An evaluation of the potential threat to human health in the absence of any remedial action.

Benchmark dose—The potential peak annual dose for a given scenario with the maximum radium concentration allowed by 10 CFR 40 Appendix A, criterion 6(6) in soil at the RWDA.

CERCLA—Comprehensive Environmental Response, Compensation, and Liability Act**—**(Also known as the Superfund Law), as amended by the Superfund Amendments and Reauthorization Act (SARA) (42 U.S.C.A. §§ 9601-9675). CERCLA provides broad authority for responding to releases or threatened releases of hazardous substances, pollutants, and contaminants.

CFR – Code of Federal Regulations

COPC—Constituent of Potential Concern**—**Chemical or radiological compounds that have been identified as a concern for human health and/or the environment at detected concentrations.

COMAR - Code of Maryland Regulations

Cost—Includes both capital and operation & maintenance (O&M) activities. Present worth analysis is utilized in order to evaluate costs over different time periods in the detailed analysis of alternatives.

Critical group—As defined in 10 CFR 20.1003, a critical group is the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

DCGL—Derived Concentration Guidance Level —A derived radionuclide-specific activity or concentration within a survey unit that is equivalent to the benchmark dose. The DCGLs are derived from activity/dose relationships through various exposure pathways. A DCGL for soil is equivalent to the activity of a radionuclide uniformly distributed in soil that would result in a total effective dose equivalent (TEDE) equal to the benchmark dose to an individual occupying the site for a calendar year.

Dose—The quantity of an active agent (substance or radiation) taken in or absorbed at any one time.

DOE—U.S. Department of Energy.

dpm—Disintegrations per minute.

Ecological Receptors—Living organisms that could be affected by contamination in the environment.

Effectiveness—The ability to reduce toxicity, mobility, or volume to minimize residual risks and provide long-term protection. Short-term impacts are evaluated in terms of the time required to provide the protection of the selected alternative.

EPA—U. S. Environmental Protection Agency.

FSS—Final Status Survey**–**A final status survey is performed under MARSSIM to release a property for a specified future use. The survey includes the collection of samples and surface scanning within the impacted areas of the site.

FS—Feasibility Study**—**A study that serves as the mechanism for the development, screening, and detailed evaluation of alternative remedial actions. It usually starts as soon as the remedial investigation is underway.

FUSRAP—Formerly Utilized Sites Remedial Action Program**—** Established in 1974 to identify, investigate, and remediate or control sites that may have been contaminated as a result of the nation's early atomic energy program. On 13 October 1997, the Energy and Water Development Appropriations Act gave responsibility for the administration and execution of FUSRAP to the USACE.

Gamma walkover survey—Surveys that identify areas of elevated radiological activity and map general patterns of contaminant distribution.

Gangue—Waste material generated during monazite sand processing. 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.

Groundwater—Underground water that fills pores in soils or openings in rocks to the point of saturation.

Land Use Controls— Physical, legal, or administrative mechanisms that restrict the use of, or limit access to, contaminated property to reduce risk to human health and the environment.

m^2—Square meters. One square meter equals 10.764 ft^2.

MARSSIM—Multi-Agency Radiation Survey and Site Investigation Manual. The Multi-Agency Radiation Survey and Site Investigation Manual, produced jointly by DOE, DOD, NRC, and EPA, provides guidance on designing and implementing statistically valid final status radiological surveys. Appendix C of MARSSIM describes the history of the statutory authority for EPA, DOE, and NRC related to radiation protection.

MDE—Maryland Department of the Environment.

Monazite, Monazite sand—A reddish-brown phosphate mineral containing rare-earth metals, thorium and uranium components (Ce, La, Y, Th) PO_4; important as a source of cerium and thorium.

mRem—Millirem; 1/1000 of a Rem (Roentgens Equivalent Man) which is a unit of radiation dose equivalent. Radiation exposures are often expressed as mRem.

NCP—National Oil and Hazardous Substances Pollution Contingency Plan, "National Contingency Plan" (40 C.F.R. Part 300). Provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

NRC—U.S. Nuclear Regulatory Commission.

PRAP—Proposed Remedial Action Plan (Proposed Plan)**—** A public document that summarizes the alternatives presented in the FS and identifies the alternative selected for implementation as part of the remedial action.

PRG—Preliminary Remedial Goal—establishes cleanup goals to be achieved, and becomes the final remediation goal in the ROD.

Progeny – An element which is created when a radioactive element (such as thorium) decays and gives off either alpha or beta radiation, and sometimes gamma radiation, thereby transforming itself into a different element. The decay of progeny continues until stable, non-radioactive progeny are formed. At each step in the decay process, radiation is released. Progeny for the radionuclides of concern evaluated at W.R. Grace include –

$\mathbf{^{232}Th}\rightarrow{}^{228}Ra\rightarrow{}^{228}Ac\rightarrow{}^{228}Th\rightarrow{}^{224}Ra\rightarrow{}^{220}Rn\rightarrow{}^{216}Po\rightarrow{}^{212}Pb\rightarrow{}^{212}Bi\rightarrow[{}^{212}Po$ or ${}^{208}Tl] \rightarrow{}^{208}Pb$(stable), and

$\mathbf{^{238}U}\rightarrow{}^{234}Th\rightarrow{}^{234m}Pa\rightarrow{}^{234}U\rightarrow{}^{230}Th\rightarrow{}^{226}Ra\rightarrow{}^{222}Rn\rightarrow{}^{218}Po\rightarrow{}^{214}Pb\rightarrow{}^{214}Bi\rightarrow{}^{214}Po\rightarrow{}^{210}Pb\rightarrow{}^{210}Bi\rightarrow{}^{210}Po\rightarrow{}^{206}Pb$(stable)

PV – Present Value - the value on a given date of a future payment or series of future payments, discounted to reflect the time value of money and other factors such as investment risk.

Radiological Screening Quotient—a numerical estimation of ecological risk. A ratio (dose ⁄ screening value) is used to estimate whether harmful effects are likely or not due to radiological contamination. If the radiological screening quotient is less than 1.0, no harmful effects are likely. If the radiological screening quotient is greater that 1.0, harmful effects are likely.

RAO—Remedial Action Objective—consist of medium-specific or operable unit-specific goals for protecting human health and the environment. RAOs aimed at protecting human health and the environment should specify: the contaminant(s) of concern, exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route.

RESRAD—RESidual RADioactivity - A computer code developed by the DOE to analyze the radiological doses resulting from occupancy of outdoor sites contaminated with radioactive material.

RI—Remedial Investigation**—**An in-depth study designed to gather data needed to determine the nature and extent of contamination at a site, establish site cleanup criteria, identify preliminary alternatives for remedial action, and support technical and cost analysis of alternatives.

ROD—Record of Decision**—**A public document that describes the selected alternative to be implemented. It also includes a presentation of the stakeholder concerns and how those concerns were addressed.

RWDA—Radioactive Waste Disposal Area—a disposal area non-manufacturing portion of the W.R. Grace Curtis Bay Facility where wastes from the monazite sand processing operations conducted in Building 23 were disposed.

$SOF_{Surface}$—Sum of fractions calculation for the surface soil interval (0 – 6 inch depth) used to assess compliance with the chemical-specific ARAR.

$SOF_{Subsurface}$— Sum of fractions calculation for subsurface soil (soil below 6 inch depth) used to assess compliance with the chemical-specific ARAR.

SU – Survey Unit - A geographical area consisting of structures or land areas of specified size and shape at a remediated site for which a separate decision will be made whether the unit attains the site-specific reference-based cleanup standard for the designated pollution parameter. Survey units are generally formed by grouping contiguous site areas with a similar use history and the same classification of contamination potential. Survey units are established to facilitate the survey process and the statistical analysis of survey data.

TBC guidance—To Be Considered guidance **-** Advisories, criteria, or guidance may be identified as "to be considered" information for a particular scenario. 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.

TEDE—Total Effective Dose Equivalent is the sum of the effective dose equivalent (for external exposure) and the committed effective dose equivalent (for internal exposure).

USACE-Baltimore—The Baltimore District of the U.S. Army Corps of Engineers.

Yd^3 - Cubic Yards

Please print or type comments here:

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PASTE
POSTAGE
HERE

U.S. Army Corps of Engineers, Baltimore District
City Crescent Building
10 South Howard Street
Baltimore, Maryland 21201
Attn: Mr. Clemens Gaines

Tape Here