AMENDED PROPOSED REMEDIAL ACTION PLAN

W.R. GRACE CURTIS BAY FACILITY
BALTIMORE, MARYLAND
BUILDING 23

*This Amended Proposed Remedial Action Plan (**PRAP**) was prepared to comply with Sections 117 (a) and 117 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA**) and Part 300.435(c)(2)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (**NCP**). This Amended PRAP describes the history of W.R. Grace Building 23, as well as the type and extent of radiological contamination in the southwest quadrant of the building. A Record of Decision (**ROD**) for this site was finalized in 2005, and the Baltimore District of the U.S. Army Corps of Engineers (**USACE-Baltimore**) subsequently oversaw remedial actions at Building 23 under the Formerly Utilized Sites Remedial Action Program (**FUSRAP**). This PRAP identifies updated remedial alternatives evaluated for Building 23 and identifies the amended preferred alternative selected by USACE-Baltimore. Consistent with Section 117 (a) of CERCLA, USACE−Baltimore and the Maryland Department of the Environment (**MDE**) encourage the public to participate in the development of the cleanup plan for Building 23. Public comment is invited on the alternatives identified in this Amended 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 and W.R. Grace, is proposing an updated remedy to address the threat to human health and/or the environment created by the presence of residual radiological activity in the southwest portion of Building 23 of the W.R. Grace, Curtis Bay Facility (see figure, next page). In the 1950s, W.R. Grace processed monazite sand to extract the radioactive element thorium under a contract with the Atomic Energy Commission (**AEC**). The processing occurred in the southwest portion of Building 23 and as a result of the processing operations, radioactive contamination remains on building components and equipment in the southwest portion of Building 23 as well as in soil beneath the southwest quadrant.

A Record of Decision (**ROD**) for Building 23 was finalized in 2005, and USACE-Baltimore subsequently oversaw remedial actions at Building 23 under the Formerly Utilized Sites Remedial Action Program (**FUSRAP**). This PRAP identifies updated remedial alternatives evaluated for Building 23 and it identifies the preferred alternative selected by the Baltimore District of the U.S. Army Corps of Engineers (USACE-Baltimore) for remediation of Building 23.

This Amended PRAP includes:

- Background information on Building 23, based on previous investigations and remedial actions (Section 2);
- A summary of risks (Section 3);
- Scope and role of 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.

This Amended PRAP summarizes information that can be found in greater detail in the Remedial Investigation (**RI**) and Feasibility Study (**FS**) reports for Building 23, as well as other documents available to the public in the designated document repositories. Information on how to participate in the decision-making process and the location of the document repositories is included at the end of this PRAP. USACE-Baltimore will finalize the remedy in a ROD Amendment after evaluating comments received from the public and consulting with MDE.

2. SITE BACKGROUND

Site Description

The W.R. Grace Curtis Bay facility is located at 5500 Chemical Road in Baltimore, Maryland. The Curtis Bay facility presently occupies 109.7 acres on an industrialized peninsula between Curtis Creek and Curtis Bay in southern Baltimore City. Building 23 is located within the active manufacturing area of the Curtis Bay facility to the west and south of Center Road, to the north of Davison Street, and to the east of Curtis Creek.

Building 23 currently houses the polyolefin catalyst processing plant. Active production operations remaining in the southwest quadrant are limited to the "Poly Corridor" portion of the polyolefin plant, along the northern edge of the southwest quadrant. Certain support operations also remain on the first floor of the southwest quadrant. The majority of the southwest quadrant of Building 23 is partitioned from the remainder of the building by walls of corrugated steel sheet. There are multiple openings between the southwest quadrant and the remainder of the building on the first, second, and third floors.

Site History

From mid-May 1956 to the spring of 1957, W.R. Grace, under contract to the AEC, processed monazite sand in the five-story southwestern quadrant of Building 23. 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, uranium, and rare earth metals. This material was placed in a landfill referred to as the Radioactive Waste Disposal Area (**RWDA**). The RWDA portion of the site is currently being addressed by USACE-Baltimore as a separate response action.

The processing system had operational difficulties, causing W.R. Grace to cease monazite sand processing operations at the Curtis Bay facility sometime in the spring of 1957. As a result of the processing operations, certain building components in the southwest quadrant of Building 23 became impacted by radionuclides. The W.R. Grace site was identified for inclusion in FUSRAP in 1984.

USACE-Baltimore conducted an RI for Building 23 in 2000/2001 and prepared an FS in 2002 that identified remedial alternatives for the site. In 2005, USACE finalized a ROD for the southwest quadrant of Building 23 identifying the selected remedy for the site. The selected remedy provided for either decontamination or

removal of areas within the southwest quadrant of Building 23 that had been impacted with FUSRAP radionuclides. The ROD indicated that, based on preliminary analysis of soil data from under the southwest quadrant, the level of radioactivity in soil was compliant with applicable regulations; therefore, no soil remediation was proposed.

From 2009-2013, decontamination and removal of building components was conducted in accordance with the 2005 ROD, including removal of equipment and building components with the highest reported radiological activity (4th and 5th Floor concrete floors and 5th Floor roof). However, data collected after completion of these remedial activities indicated that some building components remain impacted by radionuclides at concentrations exceeding the cleanup criteria for the building. Additionally, soil data collected in 2017 also indicate that the levels of radioactivity in soil exceed acceptable levels.

Site Characteristics

During the 2000/2001 RI conducted in Building 23, USACE−Baltimore identified building components and equipment (which remained from monazite sand processing) that exhibited residual radiological activity and assessed whether radiological activity exists in **groundwater** and soil under and adjacent to Building 23.

To evaluate the radioactivity of building components, alpha, beta, and gamma surveys (over 1.9 million measurements) were conducted on surfaces and building components throughout the southwest quadrant of Building 23. In addition, laboratory analysis for radioactivity was conducted on concrete and asphalt cores collected from the five floor slabs and from the roof, as well as on soil and groundwater samples collected from beneath and surrounding the southwest quadrant of Building 23.

Sediment, sludge, dust, and concrete chip samples collected from inside the building, and sediment samples collected from within the sanitary and stormwater sewer systems, were also submitted to the laboratory for analysis of radioactivity.

During the RI, 58 samples were collected from under the first floor and 8 soil samples were collected from the area outside the building [identified as a reference or background area].

The RI identified ^{238}U, ^{232}Th, and their decay progeny as contaminants of potential concern (**COPCs**) at levels above **background** on building surfaces on each of the five floors in the building. Based upon the concentration of the COPCs identified during the RI, 11 areas of concern (**AOC**) were initially identified within the southwest quadrant of Building 23, including portions of the floors, walls, and ceilings at all levels in the building as well as the soil under the first floor.

During remedial activities in 2011-2013, where decontamination and removal of building components was conducted in accordance with the 2005 ROD, several previously unidentified areas in the southwest quadrant of Building 23 were observed to contain radioactivity exceeding cleanup criteria. Additional characterization activities were conducted in the southwest quadrant in 2015 to further delineate the remaining radiological impacts, although some portions of the building remained inaccessible to characterization during this effort. Additional soil characterization activities in 2017 indicated that radionuclide concentrations exceeding the PRGs are present under much of the southwest quadrant of Building 23, in some areas to depths of at least 16 feet below ground surface. Areas identified as contaminated during and after the remedial action have not yet been remediated.

3. SUMMARY OF SITE RISKS AND REMEDIAL OBJECTIVES

Prior to finalization of the 2005 ROD, a Baseline Risk Assessment (**BRA**) was prepared for the southwest quadrant of Building 23 to evaluate the radiation exposures and risks that could occur to members of the general public if Building 23 were released and used for industrial purposes without additional cleanup or occupancy controls to limit radiological exposures within the structure. W.R. Grace indicated that Building 23 would remain in use as an industrial facility. Therefore, the BRA examined two industrial worker scenarios and one demolition worker scenario to be representative of the potential exposure to workers over the remaining life of the building, including during demolition or renovation of all or portions of the southwest quadrant of Building 23.

The objective of the BRA was to derive site-specific estimates of the radiation exposures and risks to people who may occupy the southwest quadrant of the building without cleanup or constraints on the use of the structure with respect to radiological issues.

The analysis was concerned with exposures that could occur by the following three pathways:

- External exposure from radioactivity on the floors, walls, ceiling, and localized spots, such as tanks and drains.
- Inhalation of dust contaminated with radioactive material or constituents of concern that may become airborne.
- Inadvertent ingestion of dust contaminated with radioactive material or constituents of concern.

Doses were developed for different AOCs, based on sampling results. The doses were then compared to the radiological protection standard of 100 mrem/yr, for members of the general public. Based on this comparison, exceedances of the radiological protection standards were identified for Floors 4 and 5.

Risk was then calculated following EPA guidance, as discussed in the RI/FS reports. The greatest risks from radionuclides were identified on the fourth and fifth floors, where, at some locations, the lifetime risks to industrial workers exceeded the EPA acceptable risk range of 1×10^{-6} to 1×10^{-4}. The site risks identified in the BRA were used to establish the radionuclides of concern (**ROC**s), the Remedial Action Objective (**RAO**), and Preliminary Remediation Goals (**PRG**s) for soil and building components to address the radionuclides of concern in the southwest quadrant of Building 23, as described below. Remedial goals (**RG**s) for soil and building components, based on the PRGs, were documented in the 2005 ROD.

HOW IS RISK CALCULATED?

The human health risk assessment estimates the "baseline risk" for a site, which is an estimate of the likelihood of health problems occurring if no cleanup action is performed. The method used to analyze the risk consists of a four-step process:

(l) Data Evaluation – relevant site data are compiled to characterize the contaminants of potential concern (COPCs).

(2) Exposure Assessment – 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.

(3) Toxicity Assessment – qualitative and quantitative toxicity data for each COPC are identified, and appropriate guidance levels for risk characterization are identified.

(4) Risk Characterization - the likelihood and magnitude of adverse health risks are estimated based on evaluation 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}."

A radiologic cancer risk coefficient of 7.6×10^{-7} lifetime cancer risk per **mrem** exposure (from EPA guidance entitled "Estimating Radiogenic Cancer Risk" and dated June 1994) is used to derive the lifetime cancer risks for external exposure, and Federal Guidance Report No. 13 risk coefficients are used to derive the lifetime exposures via inhalation and ingestion. For the worker scenarios, the range of values reflect occupancy at different areas of concern or survey units on each floor.

Radionuclides of Concern

The ROCs for Building 23 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. Specifically, ^{238}U and ^{232}Th, together with their decay progeny, are the radionuclides of concern for Building 23.

Remedial Action Objective

The RAO for the southwest quadrant for Building 23, which was developed to be protective of human health and the environment, is as follows:

> *To reduce the risk to current and future human receptors from building components and soil containing residual radioactivity from monazite sand processing to an acceptable level as defined in Title 10 of the Code of Federal Regulations (CFR), Part 40, Appendix A Criterion 6(6).*

The RAO is achieved by implementing the selected remedy in accordance with the established ARAR-derived cleanup goals.

Cleanup Goals for Soil

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

> *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).*

As presented in the FS, the PRG for soil of 1 (unity) represents the sum of the fractions of the total dose contributions of the individual radionuclides (including ^{238}U, ^{232}Th, and ^{226}Ra) that would not exceed the benchmark dose. RESRAD modeling was performed to determine individual radionuclide contributions. The resulting concentration limits developed for the individual radionuclides ^{232}Th and ^{226}Ra were 4.73 pCi/g and 15 pCi/g, respectively. The modeling also developed the equivalent ^{238}U concentration limit (1,372 pCi/g) necessary to achieve the benchmark dose. However, it was noted that since this concentration limit was well above the concentrations of ^{238}U observed in soil samples at the site, its dose contribution to sum of the fractions calculations was negligible. Therefore, ^{238}U was not included in the sum of fractions. The cleanup goals were subsequently finalized in the 2005 ROD as the RGs for the site.

Cleanup Goals for Groundwater and Sediment

The RI report did not identify human health risk from exposure to the FUSRAP ROCs in groundwater, because (a) site data indicate that concentrations of FUSRAP ROCs are not elevated in the groundwater and (b) groundwater is not currently consumed at the site and is not anticipated to be consumed in the future. Based on the groundwater data, there is no mechanism for transport of FUSRAP ROCs downgradient toward surface water bodies, which is supported by the fact that no elevated concentrations of FUSRAP ROCs were identified in downgradient sediment. Therefore, groundwater and sediment are not media of concern for consideration in remediation of Building 23, and no PRGs were developed for these media.

Cleanup Goals for Building Components

As documented in the ROD (2005), RGs for building components in the southwest quadrant of Building 23 were developed using the modeling software **RESRAD-BUILD**. However, revised RGs have been calculated for this Amended PRAP, based on a changed understanding of building conditions. Whereas the ROD assumed a room with dimensions 5 x 5 x 3 meters, the smallest room size that may be expected following remedial action is 6 x 5 x 4 meters. The ROD also assumed conservatively that one-fifth of the radioactivity on building surfaces is easily removed and therefore more likely to be inhaled or ingested (removable fraction = 0.2). Based on additional characterization data results collected after RI activities, the estimated removable fraction is approximately 0.1.

Based on the updated modeling, the RG for building components in Building 23 is to reduce surface radiological activity on building component surfaces to below 16,300 disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Consistent with the 2005 ROD, the RG for specific building surfaces was further defined into distinct **alpha** and **beta decay** components. The ^{232}Th series includes 6 alpha and 4 beta decays, resulting in alpha and beta fractions of 0.6 and 0.4, respectively, for the total number of decays. Applying these factors to the total PRG (16,300 dpm/100 cm^2) yields 9,780 dpm/100 cm^2 for alpha activity and 6,520 dpm/100 cm^2 for beta activity. These RGs represent the maximum activity averaged over a 100-m^2 area (termed the **DCGL$_w$**), and they are applicable for radiological concentrations above background levels.

Background Levels for Building Components

As noted during the RI/FS and subsequent remedial activities, building materials were identified to have naturally occurring levels of radiation. In accordance with the ARAR, background levels should be subtracted from data results before comparison to DCGLs.

During remedial activities in 2011-2013 (decontamination and removal of building components), reference background measurements were collected for each type of structural material expected to be encountered during final status survey (**FSS**) from non-impacted areas of Building 23 and other Curtis Bay facility structures on surfaces as similar as possible to the impacted areas to be surveyed. During supplementary characterization surveys at Building 23 (2015/2016), background was established for an additional material (painted brick). The established background levels of radiation for use in evaluating exceedances for individual building materials are identified in the following table.

Material-Specific Background Reference Values (dpm/100 cm^2)		
Material	**Alpha**	**Beta**
Bare concrete	12.1	260
Steel columns/beams	10.2	51
Metal floor plates/ diamond steel plates	6.0	73
Painted brick	0.0	579
Red brick	41.7	787
Tile floor	0.0	8
Painted cinderblock	3.8	285
Unpainted cinderblock	26.7	419
Glass windows	2.5	46
Painted metal door	3.5	35
Corrugated fiberglass wall	0.6	114
Corrugated metal wall	8.0	117
Piping	0.0	68
Pipe wrap (metal)	4.5	66
Ductwork	0.0	33
Rubber roof material	31.5	61

4. SCOPE AND ROLE OF THE RESPONSE ACTION

As stated previously, following remedial actions in 2009-2013, radiological impacts in excess of RGs remain on building components in the southwest quadrant of Building 23, as well as in soil. Therefore, it is the USACE's current judgement that active measures are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Thus, an additional response action is proposed.

The proposed response action presented in this Amended PRAP represents a revision to the previously selected FUSRAP action for Building 23. Through the use of available treatment technologies, this revised response will permanently reduce the toxicity, mobility, and volume of radioactivity, which constitutes the principal threat in the southwest quadrant of Building 23.

5. SUMMARY OF REMEDIAL ALTERNATIVES

This section presents a summary of the selected remedy from the 2005 ROD and the demolition alternative to which it is being compared, to meet the human health RAOs for the southwest quadrant of Building 23. A "No Action" alternative is also described for comparison. A detailed analysis, conducted in accordance with EPA's guidance for conducting an RI/FS under CERCLA and the NCP is included below.

The three remedial alternatives considered in this Amended PRAP for Building 23 include:

1. No Action
2. Decontamination with removal to industrial use levels
3. Demolition of southwest quadrant of Building 23

Alternative 1: No Action
Estimated Cost: $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 on building components. This alternative does not implement any activity, including land use controls **(LUCs)**.

Alternative 2: Decontamination with Removal to Industrial Use Levels (Selected Remedy in 2005 ROD)
Estimated Cost: $35,425,126
Estimated Construction Timeframe: 17 months

Alternative 2 includes decontamination of all remaining building components with surface activity above the RGs identified in the 2005 ROD. In areas where decontamination is unsuccessful, or deemed inappropriate because of the identified level of radiological activity and/or structural integrity issues associated with remaining building components, the materials would be removed.

This alternative was the Selected Remedy in the 2005 ROD, and a majority of the building components identified for remediation prior to 2005 were decontaminated or removed in 2009-2013. If this alternative was retained as the Selected Remedy in the amended ROD, it would target the additional building components that have been identified as having residual radioactivity exceeding the RGs from the 2005 ROD. As before, removal activities would be designed and coordinated to minimize disruptions to the building owner's production activities.

The majority of the remaining walls, ceilings, and structural steel framing components with surface activity above cleanup criteria would be decontaminated using chemical or mechanical decontamination

technologies. If post-decontamination surveys indicate activity above criteria, structural steel and walls would be decontaminated again and resurveyed. This iterative approach would continue until surface activity levels meet cleanup goals. Where decontamination is determined to be ineffective, building components would be removed and replaced (as required) with like materials.

Active piping and equipment removed because of residual radioactivity, or because of the physical proximity to work areas, would be replaced with like materials, or substitute materials acceptable to the building owner. Replacement of abandoned-in- place piping is not anticipated.

Other building components likely to be removed and replaced rather than decontaminated include an existing electrical substation, the asbestos-coated east wall of the southwest quadrant, the central staircase, and selected floor/roof/decking materials for which decontamination is determined not to be practicable.

Material removed from the building, as well as waste produced during decontamination or other construction activities, would be surveyed for radiological activity and sampled for chemical constituents as necessary, and disposed of at an appropriate offsite facility. (Criteria for unrestricted release of materials are defined in American National Standards Institute, Inc. [ANSI]/Health Physics Society [HPS] N13.12, which is To Be Considered [TBC] guidance for radiological release of non-building components and will be included in the amended ROD).

An FSS of Building 23 would be conducted as part of this alternative to document compliance with remedial goals.

LUCs would also be included as part of Alternative 2, since decontamination would be to industrial use criteria, and since soil exceeding RGs would remain under the concrete floor slab. LUCs would be used to ensure that future use of the building limits occupancy to levels consistent with industrial use scenarios for the remainder of its life and to ensure proper actions are taken any time the soil beneath the southwest quadrant is exposed. Five-year reviews would be performed following the completion of Alternative 2.

Note that the estimated cost for Alternative 2, as listed above, does not include costs incurred during previous phases of remediation in 2009-2013, and yet the current cost estimate is approximately 10 times more than originally estimated (see 2005 ROD), based on the level of effort expended during the previous decontamination efforts from 2009-2013.

Alternative 3: Demolition of Southwest Quadrant of Building 23
Estimated Cost: $32,418,997
Estimated Construction Timeframe: 22 months

This option includes the complete demolition of the southwest quadrant of Building 23. The 2005 ROD included evaluation of a demolition alternative for the building (specifically, demolition and reconstruction of the southwest quadrant); however, the ROD noted that the building owner did not want to demolish the entire southwest quadrant at that time. The demolition alternative identified in this PRAP (Alternative 3) includes demolition of the southwest quadrant, with minimal restoration (concrete slab on grade), as well as LUCs for soil disturbance in areas of known or suspected radiological impacts.

Prior to demolition of building components, an active electrical substation located within the southwest quadrant would be replaced, and all active utilities that traverse the southwest quadrant or that would be impacted by demolition activities would be rerouted or replaced outside of the southwest quadrant footprint.

FSS activities would be conducted to confirm that the revised $DCGL_W$ and $DCGL_{EMC}$ remedial goals identified in this Amended PRAP are met. Following demolition activities, the footprint of the southwest quadrant of the building would be restored with a new concrete pad, and soil sampling within the footprint of the southwest quadrant would be conducted prior to slab replacement to document as-left radiological conditions of soil. In addition, new exterior walls would be constructed along the eastern and northern edges of the demolition area to enclose the remainder of Building 23, and a replacement maintenance/electrical shop would be constructed on the new concrete pad.

Building components removed during demolition would be surveyed for radiological activity and sampled for chemical constituents, as necessary, and disposed of at an offsite USACE-approved disposal facility licensed or permitted to accept the waste stream. Other demolition wastes exceeding criteria for unrestricted release as defined in the most current version of ANSI/HPS N13.12 (TBC guidance for radiological release of non-building components to be included in the amended

ROD) would be disposed of at a facility licensed or permitted to accept the material.

LUCs would also be included as part of Alternative 3, because soil exceeding the cleanup goals identified in the 2005 ROD would remain under the new concrete pad. LUCs would be used to ensure that proper actions are taken any time the soil beneath the southwest quadrant is exposed. Five-year reviews would be performed following completion of Alternative 3.

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.

Threshold Criteria

Overall Protection of Human Health and the Environment

All of the alternatives except the "no action" alternative would protect human health and the environment by eliminating, reducing, or controlling risk through decontamination, removal, and/or LUCs.

Because the "no action" alternative is not protective of human health and the environment, it was eliminated from further consideration.

Compliance With ARARs

Alternatives 2 and 3 would meet the guidance for building materials with surface activity above cleanup criteria. Both alternatives would require LUCs to ensure proper actions are taken any time the soil beneath the southwest quadrant is exposed, in order to ensure compliance with the ARAR. A final status survey of remaining building surfaces would be required under Alternatives 2 and 3 to ensure compliance with ARARs.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence

Decontamination of contaminated building materials to below cleanup levels as part of Alternative 2 would provide permanence and long-term protection for human health. However, Alternative 3 would be the most effective and permanent in the long-term, as it includes removal of the majority of impacted building materials.

Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Treatment by decontamination and removal of building surfaces under Alternatives 2 and 3 would reduce the toxicity, mobility, and volume of material contaminated with FUSRAP radionuclides at the site.

Short-Term Effectiveness

There are several short-term impacts associated with Alternatives 2 and 3. Under either alternative, coordination with facility personnel would be necessary to minimize potential effects on workers and plant activity. Both alternatives have the potential to lead to dust generation, potential external exposure to radioactivity, and physical hazards associated with decontamination or demolition work. The short-term impacts associated with Alternative 3 would be more significant than Alternative 2, because the quantity of materials requiring removal will be greater for the demolition activities. The potential impacts would be addressed by instituting appropriate dust controls, monitoring for radioactivity, use of personal protective equipment, site-specific health and safety plans, and use of trained personnel and engineering methods appropriate to minimize risk. Members of the community would experience short-term impacts during off-site transportation of the materials requiring off-site disposal. Those impacts, which would include nuisance, noise, and increased traffic, would also be more significant for Alternative 3 than Alternative 2, due to a larger quantity of materials requiring off-site disposal. Actions would be taken to minimize impacts to the environment associated with each alternative.

Implementability

Alternatives 2 and 3 will employ standard demolition techniques for removal, and existing radiological decontamination techniques. In some cases, an iterative process of survey and decontamination is required to ensure that surfaces are appropriately cleaned. During preparation of the 2005 ROD, the technical feasibility of Alternative 2 was expected to be high, based on equipment availability and use of standard technologies. However, subsequent remedial activities have indicated

that Alternative 2 is not feasible, due to challenges of accessibility, time requirements of iterative surveys and decontamination, and more widespread contamination. The feasibility of Alternative 3 is high, despite the requirement for extensive logistical planning in coordination with the Curtis Bay facility, to avoid disruption of facility operations within and in areas surrounding Building 23 during utility, demolition, and restoration work. W.R. Grace has expressed support for demolition of the southwest quadrant if determined to be more implementable and effective than decontamination.

Cost

The estimated cost to complete Alternative 2 is the highest, while the cost of Alternative 3 is less expensive, and the timeframes for Alternatives 2 and 3 are similar. The cost and timeframe for Alternative 2 are associated with the most uncertainty, due to the potential for additional contamination to be identified and require decontamination, as well as the need for iterative decontamination processes.

Modifying Criteria

State/Support Agency Acceptance

The MDE is the State support and regulatory agency. MDE's comments will be formally evaluated during the public review and comment period on the RI/FS report and proposed plan.

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 ROD Amendment that selects the remedial alternative. In light of the comments received, USACE-Baltimore may change a component of the preferred alternative, select another alternative, or select another remedy. If the basic features of the "new" remedy are significantly different from what could have been reasonably anticipated from this Amended PRAP, USACE-Baltimore will seek additional public comment on a revised PRAP.

7. SUMMARY OF THE PREFERRED ALTERNATIVE

Alternative 3, *Demolition of Southwest Quadrant of Building 23*, is the preferred alternative. This alternative will minimize risk by removing the majority of building components that are contaminated with radioactivity at the site. This alternative achieves the best balance of reduced risk, implementability, and cost when compared to the other alternatives.

The preferred alternative achieves the cleanup goals discussed in Section 4 and consists of the following components:

- Rerouting or replacement of active utilities, including an existing electrical substation, to locations outside the southwest quadrant.
- Prior to demolition, FSS of the structural steel framing components along the edges of the southwest quadrant and construction of temporary exterior walls along these framing components.
- Demolition of the southwest quadrant of Building 23, including building components and the concrete slab on the first floor.
- Construction of a new concrete slab, a 1-story corridor along the northern edge of the southwest quadrant footprint, and permanent walls following demolition of the southwest quadrant.
- Construction of a new maintenance/electrical shop on top of the new concrete slab.
- Performance of FSS during and after demolition activities to document compliance with cleanup criteria.
- Establishment of LUCs to ensure that proper actions are taken in the future if soil beneath the southwest quadrant is exposed.

It is anticipated that the majority of demolition waste would be classified as radioactive waste (FUSRAP material) and disposed at an off-site facility licensed or permitted to accept the waste stream. Construction and demolition waste not originating from the southwest quadrant would be characterized as needed relative to ANSI/HPS N13.12, and disposed at an appropriate offsite facility,

The recommended alternative (Alternative 3) would provide protection to workers, the public, and the environment during cleanup. Potential short-term risks during demolition and other activities would be minimized by appropriate protective measures. This alternative would pose no potential long-term impacts to the environment.

Total costs for the preferred amended remedy (Alternative 3) are estimated at $32,418,997. The estimated time to complete the cleanup is approximately 28 months.

Alternative 3 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 remainder of Building 23.

8. COMMUNITY ROLE IN THE SELECTION PROCESS

USACE−Baltimore provides information regarding the cleanup of the southwest quadrant of Building 23 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 the Baltimore Sun. In addition, a community relations program has been established and maintained for the local community. USACE encourages public input to ensure that the remedy selected for Building 23 meets the needs of the local community, in addition to being an effective technical solution to the problem.

Although Alternative 3, Demolition of Southwest Quadrant of Building 23, is recommended, USACE specifically invites comment from the community and other interested parties on the preferred alternative as well as the acceptability of all the alternatives. Public comments that support an alternative other than the recommended remedy, 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 Amended 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 below.

At the public meeting, the background, previous remedy, history of cleanup, and current status of the site will be summarized and a summary of the proposed revised remedy will be provided. After the presentation, a question-and-answer period will be held, during which the public can submit verbal or written comments on the Amended PRAP.

USACE-Baltimore may modify the preferred alternative or select another alternative presented in the Amended PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

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

PUBLIC COMMENT PERIOD: 8 July 2019 – 9 August 2019

ADMINISTRATIVE RECORD FILE / DOCUMENT REPOSITORIES:

1. U.S. Army Corps of Engineers, Baltimore District
   2 Hopkins Plaza, Baltimore, MD 21201
   Attn: Chris Gardner
   (410) 962-2626

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

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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**—**A goal for remediation of sites contaminated with radioactive materials and exposure to radiation, which aims to protect human health and the environment by conducting a cleanup, if possible, to levels that are lower than established numerical goals. For the southwest quadrant of Building 23, a cost/benefit analysis was conducted for the AOCs in Building 23 to assess whether remedial action was necessary in the AOCs not exhibiting elevated radioactivity in order to comply with the ALARA requirement of the selected ARAR. The results of the analysis indicate that remedial actions are not necessary for the remaining AOCs in order to comply with the ALARA requirements.

Alpha Decay—Nuclear decay by emission of an alpha particle (a helium nucleus, composed of two protons and two neutrons).

AOC—Area of Concern**—**The 74 survey units exhibiting radiological activity above screening criteria that were grouped into eleven Areas of Concern identified in the RI/FS.

ARARs—Applicable or Relevant and Appropriate Requirements**—**The Federal and State environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

Background—Natural radiation or radioactive material in the environment including: primordial radionuclides (e.g., ^{238}U, ^{232}Th, ^{40}K, and ^{87}Rb), cosmogenic radionuclides, or cosmic radiation. Naturally occurring radioactive material that has been technologically enhanced is not considered background.

BRA—Baseline Risk Assessment—An evaluation of the potential threat to human health and the environment in the absence of any remedial action.

Benchmark dose—The potential peak annual dose to the average industrial worker in an outdoor setting with the maximum radium concentration allowed by 10 CFR 40 Appendix A, Criterion 6(6) in the soil across a site the size of the southwest quadrant of Building 23.

Beta Decay—Nuclear decay by emission of an electron or a positron. Positron decay is always accompanied by electron capture decay.

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 the organizational structure and procedures for responding to releases of hazardous substances, pollutants, and contaminants.

COPC—Constituent of Potential Concern**—**Chemical compounds that have been identified as a concern for human health and the environment based on the identified concentrations at a site.

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 a detailed analysis of alternatives.

DCGL—Derived Concentration Guideline 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. The DCGL for building components is equivalent to the surface activity of ^{232}Th plus its progeny uniformly distributed on surfaces that would result in a committed effective dose equivalent (CEDE) equal to the benchmark dose to an individual occupying the room for an average of 24 hours per week for a calendar year.

$DCGL_W$—The maximum activity, averaged over 100 m^2, that is allowable on building surfaces of Building 23 for future industrial use of the building.

$DCGL_{EMC}$—The maximum allowable activity averaged over an area smaller than 100 m^2 (e.g., 1 m^2 area), provided the $DCGL_W$ that is applicable for a 100 m^2 area is not exceeded.

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

DOE—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 through treatment 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. Compliance with ARARs is also evaluated as part of an alternative's effectiveness.

EPA-3—Region 3 of the U.S. Environmental Protection Agency.

FSS—Final Status Survey—Performed under MARSSIM to release a property for a specified future use. The survey includes the collection of samples and a complete surface scan of any remaining areas that have been remediated.

FS—Feasibility Study**—**Analysis of the practicability of a proposal; e.g. a description and analysis of potential cleanup alternatives for a site. The feasibility study recommends a selection of cost-effective alternatives and usually is developed 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 were 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.

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

LUC—Land Use Control—Administrative method to prevent human exposure to contaminants, such as by restricting land development, or limiting potential uses of the property (e.g. property cannot be used as a residence).

Isotope—Two or more nuclides having the same atomic number, thus constituting the same element, but differing in the mass number. Isotopes of a given element have the same number of nuclear protons but differing numbers of neutrons. Naturally occurring chemical elements are usually mixtures of Isotopes so that observed (non-integer) atomic weights are average values for the mixture.

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

MARSSIM—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**—**Equal to 1/1000 of a Rem (Roentgens Equivalent Man) which is a unit of radiation dose in tissue. The unit of mrem is used to measure the dose equivalent..

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.

Occupancy Factors—In 1986 and 1989, Oak Ridge National Laboratory (ORNL), at the request of the DOE, conducted a limited radiological survey of Building 23 to evaluate present or potential health risks. Based on the results of these investigations, ORNL established occupancy factors that would result in no unacceptable exposure inside Building 23 (i.e. limited hours for employees) for W.R. Grace operations for areas where elevated radioactivity measurements were identified. W.R. Grace continues to use these occupancy factors to limit worker exposure.

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

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

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

$^{232}Th \rightarrow (^{228}Ra \rightarrow ^{228}Th \rightarrow ^{212}Pb \rightarrow ^{212}Bi)$
parent (decay progeny)

$^{238}U \rightarrow (^{234}U \rightarrow ^{230}Th \rightarrow ^{226}Ra \rightarrow ^{214}Pb \rightarrow ^{214}Bi)$
Parent (decay progeny)

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— A computer model developed by the DOE to analyze the radiological doses resulting from the remediation and occupancy of outdoor sites contaminated with radioactive material.

RESRAD-BUILD—A computer model developed by the DOE to analyze the radiological doses resulting from the remediation and occupancy of buildings contaminated with radioactive material.

RG—Remedial Goals**—**Cleanup goals to be achieved at a site. RGs are documented in the ROD.

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.

ROC—Radionuclide of Concern**—**Radionuclides identified as indicators of potential radiological contamination, based on screening of site concentrations.

ROD—Record of Decision**—**A public document that documents the remedial action plan for the site and certifies that the remedy selection process was carried out in accordance with CERCLA and the NCP; describes technical parameters of the remedy, specifying methods selected to protect human health and the environment in the selected remedial action; provides the public with a summary of information about the site and the chosen remedy, including the rationale behind the selection; and presents stakeholder concerns and how those concerns were addressed.

RWDA—Radioactive Waste Disposal Area—The centrally located undeveloped portion of the W.R. Grace Curtis Bay Facility where waste from the thorium-processing operations conducted in Building 23 was disposed.

TEDE—Total Effective Dose Equivalent**—**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.

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