OhioEPA

State of Ohio
Environmental Protection Agency

Division of Emergency and Remedial Response

DECISION DOCUMENT

FOR THE REMEDIATION OF

Nasa Glenn Research Center at Lewis Field – Central West Area
Cuyahoga County, Ohio

Prepared by
THE OHIO ENVIRONMENTAL PROTECTION AGENCY

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: Dorothy Kessler Date: 8-5-08

Date: *May 2008*

Ted Strickland, Governor
Chris Korleski, Director, *State of Ohio Environmental Protection Agency*

DECLARATION

NASA GLENN RESEARCH CENTER AT LEWIS FIELD - CENTRAL WEST AREA, CLEVELAND, OHIO

NASA - Glenn Research Center at Lewis Field – Central West Area
Cleveland, Cuyahoga County, Ohio

STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedial action for the *NASA – Glenn Research Center at Lewis Field – Central West Area (Central West)* in *Cleveland*, Ohio, chosen in accordance with the policies of the Ohio Environmental Protection Agency, statutes and regulations of the State of Ohio, and the National Contingency Plan, 40 CFR Part 300.

ASSESSMENT OF THE SITE

Actual and threatened releases of constituents within the Central West Area, including Polyaromatic Hydrocarbons (PAHs), Arsenic, and Dieldrin, if not addressed by implementing the remedial action selected in the Decision Document, constitute a substantial threat to public health or safety and are causing or contributing to water pollution or soil contamination. These constituents were from general research and development operations at NASA – Glenn and could be related to releases from Resource Conservation and Recovery Act (RCRA) hazardous waste generator storage units. The facility has been in operation since 1941 as an aeronautical and aerospace governmental research facility.

DESCRIPTION OF THE SELECTED REMEDY

The Preferred Plan was only a preliminary recommendation to address the Site remediation. Any public comment, concerns, or recommendations on all evaluated alternatives could have influenced the final decision on the remedy selection. The decision regarding the final remedy is documented in this Decision Document after Ohio EPA has taken into consideration all public comments.

Based upon the information currently available and after review of all submitted comments, Ohio EPA's selected remedial alternative is excavation and removal of all contaminated soils above industrial/commercial cleanup goals and off-site disposal. Additionally, to ensure future use of the property is restricted to industrial/commercial uses, Ohio EPA would require the implementation of institutional controls on the NASA - Glenn Research Facility at Lewis Field – Central West Area through an environmental covenant.

It should be noted that the day care and firing range areas were remediated through interim measures prior to the Decision Document. These locations have been included

in final analysis of Construction Completion Reports and have demonstrated they met remedial goals under the risk based approach.

STATUTORY DETERMINATIONS

The selected remedial action is protective of human health and the environment, complies with legally applicable state and federal requirements, is responsive to public participation and input, and is cost-effective. The remedy uses permanent solutions to the maximum extent practicable to reduce toxicity, mobility, and volume of hazardous substances at the Site. The effectiveness of the remedy will be reviewed regularly.

7/28/08

Chris Korleski, Director Date

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For NASA - Glenn Research Center at Lewis Field - Central West Area, Cuyahoga County, Ohio

1.0 SUMMARY OF SITE CONDITIONS

1.1 Site History

The NASA - Glenn Research Center Site (NASA - Glenn) conducts research and development activities in the fields of space power generation and advanced propulsion, including aeronautical and space propulsion, nuclear and solar energy conversion systems, space power and space communications technology, space station technology, and terrestrial energy technology. NASA began operations in 1941 as the National Advisory Committee for Aeronautics (NACA) and became the National Aeronautics and Space Administration (NASA) in 1958. Currently, NASA - Glenn is a research facility that houses 146 buildings and structures on approximately 364 acres of property. The facility includes a diverse array of laboratories, office buildings, research and test facilities, support facilities, a child daycare facility, and recreational facilities.

The Site has been separated into four sub-areas, due to geography and operations (Figure 1). The North Area is north of Brook Park Road and contains two administrative office buildings. The Central Area is the largest portion of the Site and is bordered by Brook Park Road to the north and Cedar Point Road to the south. The Central Area is the main research area and houses the wind tunnel buildings and various other research facilities. The West Area is located west of Abram Creek. The West Area contains some research facilities, a daycare, and recreational facilities for NASA - Glenn. The South Area is the portion south of Cedar Point Road and bordered by the airport and the unnamed tributary to Abram Creek. A portion of the South Area has been involved in the expansion of the adjacent Cleveland Hopkins International Airport (CHIA) and is currently operated as part of CHIA's runway network.

The surrounding area is a mixture of residential, commercial, and industrial properties. To the east and southeast of the Site is CHIA. To the north and west of the Site is a mixture of residential, recreational (Rocky River Reservation), and commercial (a hotel, VFW Hall, etc.) property. To the south of the Site is a mixture of industrial activity (aerospace parkway), commercial, and residential (Ruple Parkway) property. The southern industrial area (aerospace parkway) will also become part of the airport during the expansion process.

This Decision Document concerns only the Central, Western, and Northern Areas, or Central West Area (Figure 2) that is part of NASA's research facility (Central West). The operations in these areas include the main research area, the wind tunnel buildings, and various other research facilities, along with recreational facilities, a daycare, and an old firing range. Several facilities have been relocated within the

property. This Site will be contiguous with other portions of the NASA - Glenn facility, the Ohio Aerospace Center, Aerospace Parkway, and the Rocky River Reservation.

Several environmental studies have been conducted at NASA - Glenn. In 1991 and 1992, respectively, a preliminary assessment and a supplemental assessment were conducted at NASA - Glenn and identified 63 areas of concern (AOCs) that required additional investigation. NASA - Glenn later increased the number of AOCs to 73. A Phase I RI/FS (R&R 1995) attempted to confirm and characterize the nature of contamination at the AOCs identified in the previous reports.

In September 1996, NASA - Glenn signed an Administrative Order with Ohio EPA and began the next phase of the investigation, a Phase II Remedial Investigation/Feasibility Study (RI/FS) (R&R 1999), which focused on the final characterization of the nature and extent of contamination at the Site, and included an evaluation of contaminants with respect to potential risks to human health and the environment. The sampling conducted under the RI included the U. S. EPA Target Compound List (TCL) and Target Analyte List (TAL) constituents, which includes volatile organics, semi-volatile organics, PCBs, and heavy metals. The RI/FS (R&R 1999b) identified several potential soil contaminants throughout the entire NASA facility:

Cadmium; Chromium; Copper; Lead; Mercury; Nickel; Selenium; Vanadium; and Zinc; Polyaromatic Hydrocarbons (PAHs); 4,4-DDT; Acetone; Dieldrin; Endrin; Ethylbenzene; Methylene Chloride; Toluene; and Xylene.

These constituents were later limited to the constituents within each of the three defined areas for each Feasibility Study.

1.2 Summary of the Remedial Investigation

This Decision Document contains only a brief summary of the findings of the RI and FS. Refer to the RI Report, FS, and FS Addendum for additional information on contaminant concentrations and investigation/remedial work conducted at this portion of the Site. The discussion in this section is limited to the RI that evaluated the Central West Area - NASA. The RI Report, however, encompasses the entire NASA - Glenn property, including portions not discussed in this document. The nature and extent of contamination at the NASA - Central West portion of the Site are described below for each environmental medium and the contaminants of concern attributable to the Site.

Soil borings collected during the RI revealed that the Central West area consists of stiff, cohesive brown and gray clays with laterally discontinuous, thin, non-cohesive silts, silty sands, and sand lenses. The sands and silts are moderately to poorly sorted and contain 0.8% to 19.2% clay. The thickness of the soil is highly variable, due to the extensive cut and fill operations in the past (1930's- 1950's), but soil thickness generally ranges from 40 to 50 feet below ground surface.

During the RI, 46 shallow soil samples were collected throughout the Central West area. Also, 148 deep soil borings were completed, of which 37 borings were completed as groundwater monitoring wells within the Central West Area. Two groundwater zones have been identified in the Central West Area. The primary groundwater zone is the deep shale bedrock aquifer, which is encountered at a depth of approximately 50 feet. A shallow, perched groundwater zone is encountered at a depth of approximately 20 feet. A lack of ground water accumulation within the boreholes completed during the RI indicates that the perched zone is discontinuous laterally. Surface water drainage, including ground water seeps, were evaluated to determine if migration of contaminants were discharging into the Rocky River near building 77. Finally, particulate emissions to air, adsorbed mercury studies, and radiological studies were conducted to evaluate these pathways and chemicals of concern.

The Phase II RI included a number of tasks designed to identify the nature and extent of site-related chemical contaminants. The tasks included sampling of air, water, soil, surface water, ground water, radiological sampling, soil gas survey, and mercury sampling. For soils, ground water and surface water/sediments, the analysis of samples conducted during the RI included the U. S EPA TCL and TAL constituents, which included volatile organics, semi-volatile organics, PCBs, and heavy metals. The data obtained from the investigation was used to conduct a baseline risk assessment.

A soil gas survey was conducted in the areas of Building 50 and the 35 Complex, to determine if contaminant sources related to chlorinated solvents and fuels existed that would affect indoor air quality in structures. A radiological survey was conducted in the area of Building 109, Building 16, and Building 49, because of the use of a cyclotron on site and the storage of materials from reconditioning the cyclotron. A mercury adsorption study was completed during the Phase I RI in the Rocket Laboratory area, Building 16, and Building 301. During the Phase II RI, Building 301 was again evaluated, because of the elevated concentrations of mercury identified in the Phase I study. The source of the mercury at Building 301 was determined to be a release of mercury-contaminated oil from a vacuum system in 1989. This mercury release was initially cleaned up in 1989; however, contamination still remained and was noted in the Phase I RI report. Subsequent analysis during the Phase II study identified that mercury concentrations in soil around building 301 were below risk based cleanup levels.

A biota survey was completed for the flood plain region adjacent to the NASA facility in 1994. The study determined the general habitat within the study area and identified stressed areas with significantly different patterns of abundance and diversity of species. This study also determined the potential need for an ecological risk assessment at the property.

1.2.1 Soil Contamination

During the RI, 46 shallow soil samples and 148 deep soil borings were collected in all Identified Areas (IAs) within the Central West Area, including the Firing

Range and Day Care Area (See Figure 3). The deep borings were installed to depths ranging from 0 to 100 feet below ground surface. Most of the borings were installed by a drill rig to an average depth of 20 to 40 feet to bedrock. One subsurface boring (BH 217 at building 398) was installed with a Geoprobe®. The Geoprobe® method was not generally used, because of the collapsing of the acetate liners when pushed into the dense clays of the site. All samples were analyzed for volatile organics, semi-volatile organics, PCBs, and metals. The RI/FS (R&R 1999b) identified detectable concentrations of soil contaminants in both surface and deep soils for the following constituents:

Metals: Barium; Beryllium; Cadmium; Copper; Lead; Mercury; Nickel; Selenium; Thallium; Vanadium; and Zinc

Polyaromatic Hydrocarbons (PAHs): Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoranthene; Chrysene; Fluoranthene; Phenanthrene; Pyrene Acetone; Dieldrin; Methylene Chloride; and Toluene

The maximum concentrations identified in the Central West Area for each contaminant were compared to the site-specific background performance standards for metals or U.S. EPA Region IX residential soil standards, to determine if these chemicals would require "hot spot" removal efforts. Two areas were identified as having an immediate direct contact exposure potential, the daycare and the firing range. The rest of the Central West Area had elevated concentrations above performance standards within the two hot spot areas; the following contaminants were found to necessitate further study and potential remediation:

Day Care Center: Polyaromatic Hydrocarbons: Benzo(a)anthracene; Benzo(a)pyrene; and Benzo(b)fluoranthene

These contaminants were found above performance standards in shallow soils in the playground area used by children. Due to the direct contact exposure threat of the contaminants to children, NASA proposed an "interim remedial soil removal" of all soils above the human health risk-based standards. The removal action was completed in 1998.

Firing Range: Antimony and lead contamination was elevated and required additional delineation and remediation, along with other potential contamination.

This area was singled out due to its different use in relation to the other portions of the Central West Area. The firing range area was no longer in use, but the range berms were still in place and contained the highest lead

levels on site. The firing range is in the flood plain of Abram Creek; however, it was not significantly impacting the stream, based upon surface water and sediment samples collected during the Phase II RI. The firing range was further evaluated under an interim action using the U.S. EPA's criteria for critical and non-time critical removal.

The soil leaching study using the SESOIL® modeling computer software was developed for any contaminant above the U.S. EPA Region 9 soil screening levels (SSLs) using a dilution/attenuation factor (DAF) of 20. Based upon this evaluation, eight (8) chemicals were carried through for further evaluation using the SESOIL® model. Those chemicals were:

Cadmium; Dieldrin; Methylene Chloride; Selenuim; Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoranthene; and Indeno(1,2,3,-cd)pyrene

The SESOIL® model predicts whether soil contaminants may leach into the groundwater and, thereby, contribute to the groundwater contamination. The results of the leaching study indicated that the contaminants were an order of magnitude below levels predicted to influence the quality of ground water or surface water, through the ground water seeps. The FS notes that one round of ground water sampling is necessary to confirm the model findings. Ground water sampling occurred during the FS addendum work (2004/2005), to determine if additional ground water investigation or remediation may be necessary in conjunction with evaluation of the RCRA units and site-wide. Some wells in the Building 109 area and Building 4 area were sampled to accommodate construction or utility redevelopment activities at NASA - Glenn prior to the initiation of the FS addendum. No contamination above U.S. EPA Region IX Preliminary Remediation Goals (PRGs) was identified, and all monitoring wells within the Central West Area were properly abandoned.

The detected soil contaminants listed above were also evaluated in two human health risk assessments, in the feasibility study, and in the addendum, to determine the cleanup levels necessary for these constituents. Based upon the human health risk assessment levels for an industrial/commercial use scenario, the following constituents were the only contaminants found to be a concern in soils: arsenic, polyaromatic hydrocarbons, and Dieldrin. Only arsenic was discovered in deeper soils (greater than 4 feet) and was evaluated for direct contact exposure potential to a site construction worker. NASA did further background studies and research on naturally-occurring levels of arsenic and presented documentation to Ohio EPA demonstrating that the levels identified at the Site were consistent with naturally-occurring arsenic levels in the background samples. Therefore, arsenic was eliminated from further consideration for risk analysis. The feasibility study did, however, conclude that the shallow soil contamination (0-4 feet) must address risks associated with PAHs and Dieldrin contamination in surface soils (0 to 4') in specific areas of the Central West Area; Building 21; Building 35 Complex, and Central Area AOC: Building 54, and

RCRA units Buildings 415 and104 (and 209 in the South 15). No evidence of deeper contamination was identified during the RI that exceeded standards for construction worker exposures in the 4 to 40 foot zone.

1.2.2 Ground Water Contamination

During the RI, 37 ground water monitoring wells were installed within the greater Central West Area, ranging from 20 to 100 feet below ground level. The wells were installed in two phases; one from April 4 through July 1, 1994, and one from September 30 to December 23, 1997. Two ground water zones were encountered in the greater Central West Area. The primary ground water zone is the deep shale bedrock aquifer, which is encountered at a depth of approximately 50 feet. A shallow, perched ground water zone is encountered at a depth of approximately 20 feet. Three rounds of ground water sampling were conducted as part of the RI field activities within the Central West Area. Two rounds were conducted during the Phase I RI, while one round was conducted in the Phase II RI. All ground water wells were sampled for volatile organics, semi-volatile organics, PCB/Pesticides, gross alpha/beta (building 49), and metals. A few detections of chemicals in ground water were identified in the three rounds of ground water sampling. No VOCs exceeded drinking water standards (MCLs) in the first two rounds. However, during the third round in 1998, two monitoring wells reported concentrations above MCLs for benzene near Building 77. Benzene was also detected up gradient of this location, but below MCLs. During the subsequent confirmation sampling, no benzene levels were detected above risk-based standards. Additionally, benzene was not detected in the soils around Building 77. Widely varying results for Bis(2-ethylhexyl)phthalate were reported during the three rounds of sampling. No specific source area was identified and information from the laboratory identified sample blank contamination of Bis(2-ethylhexyl) phthalate existed for the sampling set. Additional research into the detection of metals in the Central West Area was conducted in the FS. The FS concluded that naturally-occurring conditions at the site produced the exceedances of metals in ground water. The FS notes that the research activities did not use metals, except for mercury in the Central West Area, where metal exceedances were identified.

A subsequent round of ground water sampling in the Central West Area was completed in 2005 and included in the FS addendum. The FS addendum compared historic sample data and the 2005 sample data using the Mann-Whitney statistical test, to determine the differences in the two sets. Based upon the consistency in the data sets, NASA concluded the measured concentrations were representative. The sampling results did not identify any contaminants in ground water above risk-based standards. Also, the ground water future impacts were evaluated through a soil leaching to ground water model and the results support that the soil concentrations did not contain concentrations exceeding leaching values.

Further evaluation of ground water was conducted to determine impacts to surface water through ground water discharges and seeps at the Central West slope (See Section 3.2.3 - Surface Water Contamination).

1.2.3 Surface Water Contamination

Surface water was evaluated for impacts to the unnamed tributaries to Abram Creek and Rocky River. Both the shallow and deep ground water zones contribute to seasonal ground water discharges and seeps with low-flows along the valley wall of Rocky River below Building 77. The potential of contaminant discharge to waters of the state was evaluated using the SESOIL® modeling computer software for the contaminants identified in Section 3.2.1. The SESOIL® model predicts whether soil contaminants may leach into the groundwater and, thereby, contribute to the groundwater contamination. Additionally, surface water and limited sediment samples were collected in the unnamed tributary, Abram Creek, and Rocky River, to determine impacts from both the ground water and overland surface water run-off impacts from contaminated surface soils. Limited sediment sampling was conducted, because the stream and river beds consist of shale stream bed, which does not allow a great deal of sediment deposition. In areas where sediment materials were found (pools, etc.), samples were collected. All samples were analyzed for volatile organics, semi-volatile organics, metals, and water quality parameters.

During the Phase I RI/FS, 17 surface water samples were collected from the tributary, Abram Creek, or Rocky River, and 25 samples were collected from the on-site storm sewer system (1995). Although detections were noted in all water bodies, the human health risk assessment (HHRA) only identified Bis(2-ethylhexyl)phthalate to be a constituent of concern for surface water. Upstream samples were collected during the South 40 Area investigation, to determine if storm water runoff from the Cleveland Hopkins Airport or other off site sources were impacting the tributary, Abram Creek, or Rocky River. The historical up gradient sources of concern include a 72 inch outfall from the airport's storm water collection system, which has now been eliminated, up gradient industrial run off from aerospace parkway, a foundry sand disposal area along the banks of Abram Creek, and old landfills along Abram Creek (CHIA and Brook Park). Since Bis(2-ethylhexyl)phthalate was detected in upstream samples at higher concentrations, it was determined that contamination in surface water was from upstream sources and was not addressed further under the RI/FS. Additionally, soil leaching and ground water monitoring supported the conclusion that site contaminant levels were not above water quality standards for the outside mixing zone values.

The ground water seeps on the high wall below Building 77 were evaluated as potential sources to surface water. The FS determined that the low flow (1x 10-7 cuft/sec) of the seeps only occurred after rain events. Additionally, soil leaching and ground water monitoring evaluated under the risk assessment concluded

that site contaminant levels were not at a concentration that would impact surface water above water quality standards for the outside mixing zone values.

Central West Area sediment samples in Abram Creek did not contain contaminants above sediment standards. However, lead above the analytical detection limit was identified at the Firing Range Area. The Firing Range area was addressed through a non-time critical removal action.

1.2.4 Air Contamination

NASA conducted air monitoring for particulates at the Site during investigation activities, to determine if particulate emissions would impact workers at the Site. No samples obtained during investigation and soil boring activities were above risk-based cleanup levels. Therefore, air release pathways are no longer a viable concern.

1.2.5 Radiological Contamination

NASA conducted radiological monitoring for alpha, beta, and gamma particles at the Site during investigation activities, to determine if radiological emissions would impact workers at the Site. Sampling of soils, surface water (outfalls), and groundwater were conducted at Building 49 (cyclotron), and Industrial Waste System (IWS) outfalls between January 19 and January 21, 1998. No samples obtained during investigation were above risk-based levels. Therefore, radiological constituents were eliminated from further consideration at the Site.

1.3 Additional Information, Approved by Ohio EPA, Feasibility Addendum

Although the initial FS was approved on January 26, 2007, Ohio EPA identified issues with the RCRA generator units that were deferred to the Division of Emergency and Remedial Response (DERR) and by the Division of Hazardous Waste Management (DHWM) under the Remedial Design phase of the process. It was determined that accurate site wide remedial cleanup goals through the risk assessment process could not be established, because of the lack of adequate investigation of the RCRA units. The initial evaluation of the RCRA units was completed by DHWM and some remediation was completed under RCRA closure; however, DHWM never certified the closure of these units. Six of these units were within the Central West area: Buildings 11, 12, 77, 104, 109, and 415. One unit was adjacent to Building 209, which required further remediation, and was addressed under the South 15 remedial design. In September 2005, Ohio EPA requested NASA to evaluate these units in order to develop final cleanup goals for the Central West Area.

In the summer of 2005, additional soil and ground water samples were collected and analyzed at the RCRA units, to evaluate potential site-wide ground water contamination from metals. Ohio EPA also requested a revised risk assessment to address any contamination found within the RCRA units, to ensure that the site-wide remedial goals

address all contamination within the Central West area. The FS addendum evaluated soils, both shallow (0-4 feet) and deep (4-49 feet), to determine if ground water contamination existed that would affect the site-wide risk assessment. A final round of ground water sampling and analysis of the monitoring wells in the RCRA area was conducted to determine the quality of the ground water. The analysis of the ground water determined that the ground water concentrations did not exceed risk-based standards for any parameters tested.

The FS Addendum determined that ground water was not impacted at the property and found two additional remediation areas within the Central West area to be above risk based standards. Buildings 415 and 104 were identified for PAHs and included the additional PAHs; Dibenzo(a,h)anthracene; Benzo(b)fluoranthene; and Indeno(,1,2,3-cd)pyrene. These were included in the preferred alternatives for the site. The selected alternative was unchanged, except that additional soil removal would be necessary in the area of buildings 104 and 415, requiring revision of the cost estimates to include the increased soil removal and disposal.

Additional information obtained by Ohio EPA is placed in the public repository.

1.4 Interim or Removal Actions

Daycare

Based upon the RI/FS sampling data at the day care facility, building 398, NASA performed an emergency removal action/Interim Action to address the PAH contamination in the day care playground.

Sampling and analysis of shallow soils from the interior of the playground were completed in the day care area. Based upon the analysis, two shallow soil areas were identified as having elevated PAHs above U.S. EPA Region IX Preliminary Remedial Goals - residential standards. NASA removed the soils in the IA until a residential remedial risk goal was achieved. The removal occurred in 1999 and a subsequent risk assessment for the playground demonstrated that the cleanup goal of 0.278 mg/Kg met the 10^{-6} cancer risk for adults and children. Confirmation sampling showed that all soil levels after remediation were between non-detect and 0.210 mg/Kg, which is below the cleanup goal. The source of the PAHs is believed to have been air dispersion from aircraft and vehicles in the area of Building 398. The FS proposes no further action at this location. The approval did require this portion of the Central West Area be included in the final Construction Completion Report, to demonstrate that the entire site meets applicable standards. Additionally, during facilities relocation activities throughout the airport expansion project, the day care facilities were moved across the road. Currently, the former day care area is vacant land.

Firing Range

Upon completion of the RI Report, NASA noted that the contaminant levels at the Firing Range were different than the rest of the research facility. The floodplain area was different, since it was strictly used as a pistol and rifle range consisting of a stand and two berms for targeting. The highest elevated levels of contaminants were identified in the berms adjacent to Abram Creek. NASA proposed to address the Firing Range as a separate non-time critical removal, because supplemental sampling identified that the creek was not currently being impacted by the contaminants; however, the potential still exists for a release of contaminants into waters of the state. In 2004, NASA submitted an Engineering Evaluation/Cost Analysis (EE/CA) for the Firing Range identifying the additional steps necessary to address contamination in the Firing Range Area. The public meeting occurred on March 24, 2005. The remedial action was implemented in the summer of 2005.

This non-time critical removal action consisted of excavating and shifting the target berm soils to remove as many of the bullet casings as possible. The casings were then drummed and sent to a metal recycler. Upon removal of the bullet casings, the berm soils were treated with a binding agent to prevent the metal contaminants from leaching. The treated soils were tested to ensure the binding agent was successful; any soils not meeting the cleanup standard were excavated and disposed of off-site. Once the berm materials were addressed, any areas of contamination outside the berms were excavated and treated. Once all soils above remediation goals were treated and confirmation sampling demonstrated that they met cleanup standards, the site was regraded and seeded. The construction completion report was submitted on December 28, 2005, and approved on January 17, 2006. The approval did require this portion of the Central West Area be included in the final Construction Completion Report for the Central West Area, to demonstrate that the entire site meets applicable standards.

1.5 Summary of Site Risks and Need for Remedial Action

The assessment of cancer risks and non-cancer hazards to human receptors requires that exposure pathways be identified and the risks and hazards of each pathway be numerically estimated. One chemical exposure route has been identified: direct contact to surface soils. The normal criteria for acceptability of risk represent an upper bound excess lifetime cancer risk to an individual of between one in 10,000 and one in 1,000,000, and the total noncarcinogenic adverse health effects are estimated using a hazard index (HI) less than 1.0. For the NASA - Central West Property, a risk of one in 100,000 with an industrial/commercial only use was determined to be the acceptable criteria.

Adverse impacts to ecological receptors are identified as a hazard quotient and, when appropriate, a hazard index value greater than 1.0.

Baseline risk assessments were conducted to evaluate current and future risks to ecological receptors and to human health associated with contaminants present at the

Site. One was completed as part of the RI process and a revised human health risk assessment was completed in the FS Addendum. The results demonstrated that the existing concentration of contaminants in one environmental media (soil) poses a risk to human receptors at a level sufficient to trigger the need for remedial actions. The risk is associated with specific AOCs within the Central West Area, Building 21, Building 35 Complex, and Central Area AOC: Building 54, Building 415, and Building 104. The chemicals of concern within these areas are PAHs, Dieldrin, and Arsenic.

The ecological screening risk assessment did not identify any potential receptors. The analysis of the ground water seeps identified that no contaminants were entering waters of the state above water quality standards. Based upon the soil leaching model and confirmation sampling and analysis in 2004/2005, the contaminants in soils, ground water, and ground water seeps did not impact the unnamed tributaries above water quality standards.

In September 2003, Ohio EPA required NASA to evaluate the RCRA units under a FS Addendum, to determine final risk goals. The risk from these units was assessed in the FS addendum and included these areas: Building 12; Building 77; Building 104; Buildings 109 &136: Building 415; and Building 11 (and Building 209 in the South 15 area). A revised human health risk assessment was completed as part of the FS addendum. The calculated PRGs under the FS were unchanged; however, the addendum HHRA identified additional COCs, Dibenzo(a,h)anthracene, Benzo(b)fluoranthene, and Indeno(1,2,3-cd)pyrene.

1.5.1 Risks to Human Health

The Baseline HHRA, dated March 2000, concluded that only four detected soil contaminants exceed acceptable risk levels. These constituents were benzo(a)pyrene; benzo(a,h)anthracene; dieldrin; and arsenic. The risks were evaluated for the industrial/commercial workers at the Site, as well as potential future construction workers, within the three areas with elevated levels. Upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. The remaining two polyaromatic compounds and dieldrin were considered in the development of remedial alternatives.

A few detections of chemicals in ground water were identified during the three rounds of ground water sampling. No VOCs exceeded drinking water standards (MCLs) in the first two rounds. During the third round, in 1998, two monitoring wells reported concentrations above MCLs for benzene near Building 77. Benzene was also detected up gradient of this location, but below drinking water MCLs. During the subsequent confirmation sampling, no benzene levels above risk-based standards were found. Additionally, benzene was not detected in the soils around Building 77. Widely varying results for bis(2-ethylhexyl)phthalate were reported during the three rounds of sampling. None demonstrated any trend or plume from a specific source area and information from the laboratory

identified blank contamination of bis(2-ethylhexyl) phthalate existed for the sampling set.

Additional research into the detections of metals in the Central West Area was conducted as part of the FS. The FS concluded that naturally-occurring conditions at the site produced the exceedances of metals in ground water. The FS notes that the research facility did not use metals, with the exception of mercury in the Central West Area.

A subsequent round of ground water sampling in the Central West Area was completed during the FS addendum in 2005. The FS addendum compared historic sample data and the 2005 sample data using the Mann-Whitney statistical test, to determine the differences in the two sets. Based upon the consistency in the data sets, NASA concluded the measured concentrations were representative. Sampling results found some detections of chemicals and a risk assessment was completed for the site-wide ground water. The sampling results did not identify any contaminants in ground water above risk-based standards. The ground water future impacts were evaluated through soil leaching to ground water and the results support that the soil concentrations did not contain concentrations exceeding leaching values. For metals, the evaluation through the risk assessment found metal levels to be below human health risk levels.

Soil and ground water contamination from RCRA generator units assessed during the FS addendum include: Building 12; Building 77; Building 104; Buildings 109 & 136; Building 415; and Building 11. Only Buildings 415 and 104 were found to have areas of soil contamination above remedial risk goals and have been added to the remedial alternatives. A revised human health risk assessment was completed as part of the FS addendum. The calculated PRGs under the FS were unchanged for commercial/industrial exposures; however, the addendum HHRA identified additional COCs, Dibenzo(a,h)anthracene, Benzo(b)fluoranthene, and Indeno(1,2,3-cd)pyrene. No ground water issues were identified during the FS addendum investigation.

1.5.2 Risks to Ecological Receptors

A baseline risk assessment was conducted for ecological receptors and concluded that the Site had no impact on any ecological receptors. The potential receptors shown to be at risk were aquatic receptors in the unnamed tributary, Abram Creek, and Rocky River. However, the data demonstrated that the impacts were from upstream facilities, such as Cleveland Hopkins Airport and Aerospace Parkway. Sampling and analysis of seeps, surface water and sediments upstream, on Site and downstream, demonstrated that the NASA facility did not exceed any ecological risk level for aquatic receptors at the Site.

The potential for terrestrial receptors (deer, birds, and plants) was evaluated and no terrestrial receptors were found to be impacted by contamination at the NASA Facility. Therefore, no additional assessment was conducted for ecological receptors.

1.5.3 Summary of Risks

The risk assessments completed for the Site, the Baseline, Revised HHRA in the FS and FS addendum, and the Ecological Risk Assessment identified only soils as a constituent of concern. There were no impacts found to ecological receptors or to ground water, including impacts from leaching of soils. Therefore, the risk assessment evaluation identified only soil constituents to human receptors to be a complete pathway. The chemicals of concern were identified as: benzo(a)pyrene; DIbenzo(a,h)anthracene; dieldrin; benzo(a)anthracene; Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene and arsenic. However, upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. Therefore, this constituent, arsenic, was not considered a risk and was not included in the evaluation of remediation alternatives.

Table 1: Summary of Contaminants of Concern

Constituents of Concern in FS:

Chemical of Concern	Industrial Worker Cleanup Goal (1 in 100,000 risk level)	Construction Worker Cleanup Goal (1 in 100,000 risk level)
Benzo(a) anthracene	28.8 mg/Kg	278 mg/Kg
Benzo (a) pyrene	2.88 mg/Kg	27.8 mg/Kg
Dieldrin	1.53 mg/Kg	14.8 mg/Kg

Constituents of Concern added in the FS Addendum:

Chemical of Concern	Industrial Worker Cleanup Goal	Construction Worker Cleanup Goal
Dibenzo(a,h)anthracene	2.88 mg/Kg	27.8 mg/Kg
Benzo (b)fluoranthene	28.8 mg/Kg	278 mg/Kg
Indeno(1,2,3-cd)pyrene	28.8 mg/Kg	278 mg/Kg
Arsenic ***	*24.6 mg/kg*	*164 mg/Kg*

*** ***Upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. Therefore, this constituent was not considered in the evaluation of remediation alternatives.***

2.0 REMEDIAL ACTION OBJECTIVES

As part of the RI/FS process, remedial action objectives (RAOs) were developed in accordance with the National Contingency Plan, 40 CFR Part 300 (NCP), which was promulgated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and U.S. EPA guidance. The RAOs are goals that a remedy should achieve in order to ensure the protection of human health and the environment. The goals are designed specifically to mitigate the potential adverse effects of Site contaminants present in environmental media. For environmental media, remediation levels were developed for one in 100,000 of potential residual carcinogenic risk levels and using a non-cancer hazard index of 1.0 for potentially exposed receptors (i.e., the industrial worker and the future construction worker).

Carcinogenic risks are estimated as the unitless probability of an individual developing cancer over a lifetime, as the result of exposure to the potential carcinogens related to the Site. For any individual determined to be in the exposed population, this risk is in excess of the risk to that individual by factors not related to the Site. (See the Central West Human Health Risk Assessment of March 2000 for further discussion of Site specific risks and the FS addendum, June 29, 2007.)

The RAOs were developed to ensure that remedial actions reduce the projected risk to humans to acceptable levels. The U.S. EPA, through the NCP, defines acceptable remediation goals for known or suspected carcinogens to be concentration levels that represent an upper bound excess (above background) lifetime cancer risk to an individual between one in 10,000 and one in 1,000,000 using information on the relationship between dose and response with the one in 1,000,000 risk level as the point of departure. Likewise, noncarcinogenic risks are also to be reduced to an acceptable level. In a similar manner, important ecological resources (e.g., waters of the state or endangered species) will also be protected. For the NASA - Central West Area, the receptors found to be at risk from soils were the industrial worker (zero - four feet) and the future construction worker (4 to 49 feet). No ecological receptors were found to be at risk, pursuant to the ecological baseline risk assessment and the future use of the property (up-stream elimination of the unnamed tributary). The area of most concern for aquatic receptors would be the unnamed tributary and Abram Creek. This unnamed tributary is from a previous storm water outfall emanating from Cleveland Hopkins Airport. The outfall has since been eliminated. The Abram Creek concerns from the Firing Range berms were addressed under a non-time critical removal action separate from this Decision Document.

The RAOs developed for the Site are detailed below:

(1) Reduce or eliminate the direct contact threat to human health and the environment associated with contaminated soils.

(2) Prevent or eliminate migration of contaminants from source materials to ground water.

(3) Reduce or eliminate migration of contaminants from entering Abram Creek or the Rocky River.

(4) Protect future workers from direct contact with contaminated soils and ground water.

3.0 SUMMARY OF REMEDIAL ALTERNATIVES

Six alternatives were considered in the FS and Preferred Plan. A brief description of the major features of each of the alternatives follows. More detailed information about these alternatives can be found in the FS and FS Addendum. Ohio EPA has selected Alternative 6, Excavation of Contaminated Materials and Off-Site Disposal as the remedial alternative with the addition of an institutional control to ensure commercial/industrial land use of the Site.

3.1 No Action

The FS Alternative (Alternative -1) proposes no further action to be taken at the Site. Alternative - 1 would leave the Central West area "as is" with neither remediation nor any containment at the site. Contaminated soils would remain in place at the site and the site would remain as it is described in the remedial investigation and human health risk assessment. The NCP requires evaluation of a "no action" alternative to establish a baseline for the comparison of other remedial alternatives. Under this alternative, no remedial activities or monitoring are performed.

3.2 SELECTED ALTERNATIVE - Excavation of Contaminated Material and Off-Site Disposal

The FS Alternative (Alternative - 6) would include excavation of all soils above risk-based cleanup standards. The excavation of soils would include contaminated soils above risk based cleanup standards within the top four feet of the ground surface. All excavated soils would be disposed of off-site in a licensed solid waste facility. Once soils are excavated, confirmation samples would be collected, to confirm that the removal accomplished the RAO. No Operation and Maintenance (O&M) Plan would be required. Industrial/commercial land use restrictions, through an environmental covenant, would be part of the post-remedial actions for this alternative. No soils below the four foot depth were found to be above risk-based standards for the construction and excavation worker exposure pathway.

Ohio EPA would additionally require that an environmental covenant be recorded for the Central West Area, at the time the remediation is complete, to restrict use to industrial/commercial activities. The institutional control would be in the form of an environmental covenant filed on the deed.

3.3 Institutional Controls

The FS Alternative (Alternative - 2) would use institutional controls (ICs) as the completed remedial action in the Central West Area. The ICs restrict or limit human exposures to contaminated areas of the Site. ICs would include a deed restriction to limit the land to industrial/commercial use through an environmental covenant. NASA - Glenn, a government facility, is already fenced to restrict access; signs are posted that

identify NASA - Glenn as a government restricted access facility. NASA has guards that control access to NASA - Glenn and patrol the grounds.

This alternative would require no remediation of the contamination, but would limit the site to industrial/commercial use. Although access is restricted, the IC will not protect against direct contact with areas where contamination remains. All contaminants would remain in place at the Site.

3.4 Containment by Installing a Cap

The FS Alternative (Alternative - 3) would include installation of a cap on areas that exceed remedial cleanup standards. The cap will be one of the three general types of caps: an asphalt/concrete cap to limit infiltration into the areas of contamination; a solid waste cap consistent with the applicable solid waste regulations; or a hazardous waste cap consistent with applicable hazardous waste regulations. Generally, contaminated soils would be capped using an appropriate barrier layer and drainage layer consistent with specifications in the Solid Waste "1976 Cap System" guidance. The capping may consist of compacted soils or another capping system, pursuant to the applicable solid waste requirements under the 1976 rules, Ohio Administrative Code (OAC) Chapter 3745-27. This alternative would leave all contaminants in place, even those above risk-based cleanup levels, but would eliminate the casual direct contact exposure of contaminants to humans and the environment. However, it would not protect construction workers during routine subsurface maintenance work. Engineering controls would require the implementation of an O&M Plan, to assure that human health and the environment continue to be protected by employing proper maintenance of the caps.

Site-wide ground water was evaluated through both sampling and a leaching model; as a result, no impacts, either current or future, are expected above remedial goals. Based upon this evaluation, no remedy is necessary for groundwater at the site.

3.5 In-Situ Treatment

The FS Alternative (Alternative - 4) would include selection of an in-situ treatment technology appropriate for the soil material and location, implementation of in-situ treatment, off-site disposal of residual materials above the risk-based cleanup levels, and confirmatory sampling that all levels are below the cleanup standards. The in-situ treatment selected in the FS is vitrification, a thermal treatment in which electric current is used to melt soil or other earthen materials at extremely high temperatures. The treatment would only be conducted for contaminated soils above risk based cleanup standards within the top four feet of the ground surface. Once the treatment is complete, sampling of residual areas would be conducted. Any material above cleanup standards would be disposed of off- site in an appropriate waste facility. This alternative would reduce contaminant levels to below risk-based cleanup standards in soils in the 0-4 foot zone and would be consistent with future use of the Site through treatment. No O&M Plan would be required. Land use restrictions, through an environmental

covenant, would be part of the post-remedial actions for this alternative. No soils below the four foot depth were found to be above risk-based standards for the construction and excavation worker exposure pathway.

Site-wide ground water was evaluated through both sampling and a leaching model; as a result, no impacts, either current or future, are expected above remedial goals. Based upon this evaluation, no remedy is necessary for groundwater at the site.

3.6 Ex-Situ Soil Treatment and Off-Site Disposal of Constituents Above Cleanup Standards

The FS Alternative (Alternative - 5) would include selection of an ex-situ treatment technology appropriate for the soil material and location, excavation of the contaminated soils, implementation of ex-situ treatment, off-Site disposal of residual materials above the risk-based cleanup levels, confirmatory sampling that all levels are below the cleanup standards, and replacement of the treated materials. The proposed ex-situ treatment is high temperature thermal desorption, a physical separation process that uses one of two systems - rotary dryer or thermal screw. Both systems would require an air pollution control system for particulates and off-gas materials. The treatment would only be conducted for contaminated soils above risk based cleanup standards within the top four feet of the ground surface. Once the treatment is completed, sampling of treated materials would be conducted. Any material above cleanup standards would be disposed of off Site in an appropriate waste facility. This alternative would reduce contaminant levels to below risk-based cleanup standards in soils in the 0-4 foot zone and would be consistent with future use of the Site through treatment. This remedy differs from Alternative - 4, since the contaminated soils would be excavated from the ground prior to treatment. A treatment unit would be brought on Site. Because the waste is to be excavated and treated on site, the management and disposal of the waste will be subject to all appropriate and applicable rules and regulations. Land use restrictions, through an environmental covenant, would be part of the post-remedial actions for this alternative.

4.0 COMPARISON AND EVALUATION OF ALTERNATIVES

4.1 Evaluation Criteria

In selecting a remedy for a contaminated site, Ohio EPA considers the following eight evaluation criteria as outlined in U.S. EPA's NCP promulgated under CERCLA (40 CFR 300.430):

1. Overall protection of human health and the environment - Remedial alternatives shall be evaluated to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site.

2. Compliance with all applicable or relevant and appropriate requirements (ARARs) - Remedial alternatives shall be evaluated to determine whether a remedy will meet all of the applicable or relevant and appropriate requirements of state and federal environmental laws.

3. Long-term effectiveness and permanence - Remedial alternatives shall be evaluated to determine the ability of a remedy to maintain reliable protection of human health and the environment over time, once pollution has been abated and RAOs have been met. This includes assessment of the residual risks remaining from untreated wastes, and the adequacy and reliability of controls, such as containment systems and institutional controls (*i.e.*, environmental covenant).

4. Reduction of toxicity, mobility, or volume through treatment - Remedial alternatives shall be evaluated to determine the degree to which recycling or treatment are employed to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. Short-term effectiveness - Remedial alternatives shall be evaluated to determine the following: (1) short-term risks that might be posed to the community during implementation of an alternative; (2) potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; (3) potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and (4) time until protection is achieved.

6. Implementability - Remedial alternatives shall be evaluated to determine the ease or difficulty of implementation and shall include the following as appropriate: (1) technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy; (2) administrative feasibility, including activities needed to coordinate

with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and (3) availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

7. Cost - Remedial alternatives shall evaluate costs and shall include the following: (1) capital costs, including both direct and indirect costs; (2) annual O&M costs; and (3) net present value of capital and O&M costs. The cost estimates include only the direct costs of implementing an alternative at the site and do not include other costs, such as damage to human health or the environment associated with an alternative. The cost estimates are based on figures provided by the FS.

8. Community acceptance - Remedial alternatives shall be evaluated to determine which of their components interested persons in the community support, have reservations about, or oppose. This assessment was completed based upon comments on the Preferred Plan through the public comment period (ended April 21, 2008) and the public hearing (April 14, 2008). Section 7.0 provides the Responsiveness Summary regarding all comments received and notes any changes to the remedial alternative based upon these comments.

Evaluation Criteria 1 and 2 are threshold criteria required for acceptance of an alternative that has accomplished the goal of protecting human health and the environment and has complied with the law. Any acceptable remedy must comply with both of these criteria. Evaluation Criteria 3 through 7 are the balancing criteria used to select the best remedial alternative(s) identified in the Preferred Plan. Evaluation Criteria 8, community acceptance, is a modifying criterion that was evaluated through public comments on the alternatives received during the comment period, which ended April 21, 2008.

4.2 Analysis of Evaluation Criteria

This section examines how each of the evaluation criteria is applied to each of the remedial alternatives identified in Section 3.0 and compares how the alternatives achieve the criteria.

4.2.1 Overall Protection of Human Health and the Environment

Evaluation of the overall protectiveness of the alternatives focused on whether each alternative achieves adequate protection of human health and the environment. Additionally, the evaluation identifies how site risks posed through each pathway are eliminated, reduced, or controlled by the alternative. This evaluation also includes consideration of whether the alternative poses any unacceptable short-term or cross-media impacts.

Alternative 1 is not protective of human health or the environment.

Alternative 2, using only institutional controls, is not protective of human health or the environment, since this alternative would do nothing to prohibit direct contact with contaminants.

Alternative 3, using capping only, is protective of human health and the environment for direct contact with contaminants for most individuals; however, it would not protect the construction worker without an adequate Risk Mitigation Plan (RMP) that describes what protective measures are necessary for subsurface activities. In addition, the cap would be considered an engineering control and would require proper operation and maintenance.

Alternatives 4, 5, and 6 would be protective of human health and the environment for direct contact in soils in the 0-4 foot zone; no deeper soils were found to be above risk-based standards. Remedial measures performed under these alternatives would result in the reduction of COCs in soils to levels that meet site-specific risk-based concentrations (RBCs). Direct contact with soils below four feet of the ground surface would be limited to construction workers. Although soils below the four foot depth contain contaminants, the human health risk assessment determined that those soils met risk-based standards for the applicable pathway – construction/excavation workers.

Below is a table of alternatives and compliance with the eight criteria (Table 2).

Table 2: Summary of Evaluation Criteria

Evaluation Criteria	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*	*Alternative 5*	*Alternative 6*
(1) Overall protection of human health and the environment	☐	☐	◘	■	■	■
(2) Compliance with ARARs	☐	☐	■	■	■	■
(3) Long term effectiveness and permanence	☐	☐	◘	■	■	■
(4) Reduction of toxicity, mobility or volume through treatment	☐	☐	◘	◘	◘	■
(5) Short term effectiveness	☐	☐	■	◘	◘	◘
(6) Implementability	■	■	■	■	■	■
(7) Cost	---	*$2.0865 million*	*$2.8691 million*	*$1.4261 million*	*$1.1777 million*	*$0.3341 million*
(8) Community acceptance	*Community acceptance of the preferred alternatives will be evaluated after the public comment period.*					

■ *Fully meets criteria* ◘ *Partially meets criteria*

☐ *Does not meet criteria*

4.2.2 Compliance with ARARs

Alternatives 1 and 2 do not meet ARARs for the Site. Based upon the evaluation, wastes would remain in place above cleanup standards and; therefore, not conform to ARARs for protection of human health and the environment. Additionally, no measures would be in place for soil excavation or movement that could generate wastes.

Alternative 3 would meet ARARs based upon requirements of the solid waste and/or hazardous waste regulations. Alternatives 4 and 5 would meet chemical-specific, location-specific, and action-specific ARARs. These alternatives meet Site RAOs through containment, removal, and treatment of contaminated media, as long as future use of the NASA facility is restricted to commercial and industrial use. Alternative 6 would meet ARARs based upon requirements for disposal under solid and hazardous waste regulations.

4.2.3 Long-Term Effectiveness and Permanence

Alternatives 1 and 2 would provide no long term effectiveness or permanence, since no action to remediate the risk would be performed. Alternative 3 may provide long-term effectiveness for direct contact exposures, provided that the cap remains undisturbed and is maintained in accordance with the applicable rules and regulations. However, construction workers could be exposed if excavation activities occur in contaminated areas.

Alternatives 4, 5, and 6 would provide high long-term effectiveness and permanence for direct contact exposure to soils, since the contaminated soils above risk cleanup goals, within the top four feet of the ground surface, would be remediated either by treatment or excavation. Alternatives 4 and 5 could be less effective if treatment of the materials would not be fully completed and residuals remain in the treated area. Alternative 6 would be the most permanent remedy, since contaminated materials above risk cleanup goals would be fully removed from the Site.

4.2.4 Reduction of Toxicity, Mobility or Volume by Treatment

Neither Alternatives 1 nor 2 reduce or eliminate toxicity, mobility, or volume, since no action to remediate the risk would be performed. Alternative 1 is no action and Alternative 2 would only use legal instruments to restrict Site activities. Alternative 3 would cap the contamination, but would leave it in place; therefore, there would only be a limited reduction in mobility. The cap would reduce surface water infiltration, thereby, reducing the mobility of contaminants to the ground water; however, the toxicity and volume would remain at the current level.

Alternatives 4, 5, and 6 consist of treatment or removal to either reduce toxicity or eliminate the volume of the contaminated materials. Alternatives 4 and 5 would use treatment systems to reduce the toxicity of the contaminants through thermal treatment. These treatment systems could leave residual materials on-site and the treatment systems would need to be monitored for potential air emissions from the superheating of the contamination.

Alternative 6 is the best alternative under this criterion, since all contamination above risk cleanup goals would be removed and no elevated toxicity would remain above industrial standards consistent with proposed future use.

4.2.5 Short-Term Effectiveness

Alternatives 1 and 2 would provide no short term effectiveness, since no action to remediate the risk would be performed. Alternative 3 would provide some short-term protection to site workers and visitors through implementation of Health and Safety Plan requirements for the duration of the remedial work to be conducted.

The short term effectiveness of the remedy would be limited to the protectiveness of the health and safety plan during construction. Additionally, if the operations within the area breach the cap, the effectiveness would be compromised. However, risks associated with wastes left in place would be a concern, since these materials would still be in place during the construction of the remedy.

Alternatives 4 and 5 would protect on-site workers and visitors by implementation of the Health and Safety Plan requirements for the duration of the remedial work to be conducted. However, risks associated with Alternatives 4 and 5 treatment technologies would need to be included in the short-term effectiveness determination under the Health and Safety Plan. The wastes would still be on-site during treatment and potential off-gas products or by-products of treatment could be generated.

Alternative 6 would protect on-site workers and visitors by implementation of the Health and Safety Plan requirements for the duration of the remedial work to be conducted. However, risks associated with wastes removed would still be a concern, since these materials would be generated during construction of the remedy and transported to a new location, which could cause some short-term issues.

4.2.6 Implementability

Alternative 1 is implementable; however, it is not protective of human health and the environment.

Alternative 2 is implementable by NASA. This would involve the recording of use restrictions through an environmental covenant.

Alternative 3 is implementable by NASA, but would require compliance with O&M requirements under the Administrative Orders by NASA. Permitting requirements for this alternative are achievable to coincide with the implementation of the remedy.

Alternative 4 is implementable by NASA. The treatment technology is commercially available and, based upon current information, would be appropriate for the Site conditions. However, it is unknown, at this time, if this treatment would be successful and, therefore, may require additional treatment or measures to ensure protectiveness. Permitting requirements for this alternative are achievable to coincide with the implementation of the remedy.

Alternative 5 is implementable by NASA. The treatment technology is commercially available and, based upon currently known Site conditions, the technology is appropriate. Permitting requirements for this alternative are achievable to coincide with the implementation of the remedy.

Alternative 6 is implementable at the Site. All equipment and qualified operators are readily available.

Alternative	Estimate Time to Complete
1 - No Action	Immediate
2 - Inst. Controls	360 months to indefinite (maintain restrictions)
3 - Cap	2 months treatment + O&M
4 - In-Situ & Cap	5 months treatment with cooling period
5 - Ex-Situ	2 months
6 - Excavation	2 months

4.2.7 Cost

Below is a breakdown of costs of each alternative, including the cost of implementing the remedy, post remedial costs for O&M, and periodic reviews (five year reviews required by CERCLA) with contingency and indirect costs. For additional detail on the cost estimates, please review the "CERCLA Feasibility Study Addendum for the NASA Glenn Research Center - Central and West Areas," dated June 2007, Appendix B of the Feasibility Study Addendum.

Please note, since the treatment volume for Alternatives 4 and 5 is relatively small, mobilization of this operationally intensive system is impractical for the expense incurred. Alternative 6 would be preferable, since the relatively small volume of contaminated soils make this alternative much more practical. Contaminated soils could be directly loaded onto trucks and shipped off-site in a less expensive manner.

Costs of Remedial Alternatives
FY $2004 (as in appendix A)

Alternative	Design Implement Cost	Contingency Costs and Indirect Costs (cost adjustment from 2004)	TOTAL COST OF REMEDY
1 - No Action	$0.00	$0.00	**$0.00**
2 – Institutional Controls	$1,500,000.00	$481,500.00	**$1,981,500.00**
3 - Capping	$2,062,000.00	$662,100.00	**$2,724,100.00**
4 - In-Situ Treatment	$1,025,000.00	$329,100.00	**$1,354,100.00**
5 - Ex-Situ Treatment	$ 774,000.00	$248,700.00	**$1,022,700.00**
6 - Excavation	$ 240,000.00	$ 77,100.00	**$ 317,100.00**

Revised Costs (FFY 2006)

Alternative	Current Costs + Remedial Contingencies	Indirect Costs	TOTAL
1- No Action	$0	$0	$0
2 - Institutional Controls	$1,605,000.00	$481,500.00	$2,086,500.00
3 - Capping	$2,207,000.00	$662,100.00	$2,869,100.00
4 - In-Situ Treatment	$1,097,000.00	$329,100.00	$1,426,100.00
5 - Ex-Situ Treatment	$ 829,000.00	$248,700.00	$1,177,700.00
6 - Excavation	$ 257,000.00	$ 77,100.00	$ 334,100.00

4.2.8 Community Acceptance

Ohio EPA received comments from interested parties during the public comment period, which ended on April 21, 2008, and at the public meeting held at the Fairview Park Branch of the Cuyahoga County Public Library, on April 14, 2008. Those comments and Ohio EPA's responses are included in the Responsiveness Summary (Section 7.0). Remedial alternatives were evaluated to determine which of their components interested persons in the community support, have reservations about, or oppose. This assessment was completed through Ohio EPA's public comment period (ending on April 21, 2008) and public hearing (April 14, 2008). During the public comment period, only one written comment was received regarding the constituents of concern (see section 4.2.8) and one oral comment was received during the public hearing (transcript in Appendix B).

No comments were received that did not support the selected remedial alternative.

The written comment received was from NASA Glenn regarding arsenic being included as a constituent of concern under the FS addendum. This was modified by a footnote to Table 1 in Section 1.5.3. The oral comment was from a citizen who was concerned whether ground water and surface water potential contamination could impact her property. However, her property is to the south of the site and the flow of both the ground water and surface water bodies is to the North. Also, no ground water or surface water contamination attributable to the NASA – Central West Area was found to be above risk remediation goals for the site.

4.3 Summary of Evaluation Criteria

Based on information currently available, Ohio EPA believes the selected alternative meets the threshold criteria and provides the best balance of considerations among the other alternatives with respect to balancing and modifying criteria. Ohio EPA expects the selected alternative to satisfy the following requirements: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize

permanent solutions and alternative treatment technologies (*e.g.*, innovative) to the maximum extent practicable; 5) satisfy the preference for treatment as a principal element; and 6) has community support. Ohio EPA's selected alternative consists of the following:

Excavation and removal of contaminated soil;

Implementation of institutional controls on the NASA facility through an environmental covenant limiting the facility to commercial/industrial land use.

Note: The Day Care and Firing Range were already remediated through interim remedial measures. These locations have been included in final analysis of Construction Completion Report and have demonstrated they met remedial goals under the risk based approach.

5.0 SELECTED REMEDIAL ALTERNATIVE

Ohio EPA's selected remedial alternative is Alternative 6, excavation and off-site disposal of contaminated soils above risk-based cleanup standards. This alternative was selected because it will immediately address the direct contact exposure to contaminated soils on the NASA facility. The implementation of institutional controls via an environmental covenant will ensure that receptors continue to be protected. It is estimated that this remedial alternative will meet the site-specific RAOs within approximately two years and is considered cost effective.

Based on information currently available, Ohio EPA believes the selected alternative meets the threshold criteria and provides the best balance of considerations among the other alternatives with respect to balancing and modifying criteria. Ohio EPA expects the selected alternative to satisfy the following requirements: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies (*e.g.*, innovative) to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element. Ohio EPA's selected alternative consists of the following:

> **Excavation and removal of contaminated soil; Implementation of institutional controls on the NASA facility through an environmental covenant limiting the facility to commercial/industrial land use.**
>
> *Note: The Day Care and Firing Range were already remediated through interim remedial measures. These locations have been included in final analysis of Construction Completion Report and have demonstrated they met remedial goals under the risk based approach.*

The elements of Alternative 6 are as follows:

5.1 Soil Excavation

Soils will be excavated and transported from the site in tarp-covered trucks, in order to limit the potential for contamination of areas off-facility. Air monitoring will be performed at the former facility boundaries during the excavation, to ensure that workers are protected.

Contaminated materials within the Central West Area will be disposed of at facilities identified by NASA and approved by Ohio EPA prior to disposal. Soil characterization will be performed to determine how to properly dispose of the waste. Since contaminated soils would be considered a solid waste, at a minimum, any soil staging would require erosion control materials (straw, silt fence, etc.) if soils were staged prior to final loading and transportation. Additionally, staging details would need to be included in the Remedial Design Work Plan. A health and safety plan would be developed and implemented to ensure worker safety while excavation is completed.

Performance Standard(s):

Soils that exceed the risk remediation goal for industrial/commercial use, one in 100,000 risk level, must be excavated. The standard would be achieved upon certification of removal of the contaminated soil. That certification would be based upon previous mapping of the contaminated areas and/or confirmatory sampling of remaining soils.

Although there are other PAH compounds in the soil, benzo(a) pyrene will be used as the surrogate for determining the appropriate cleanup of the Site. Benzo (a) pyrene has the lowest cleanup standard and would drive the risk for the site. All areas of soil contamination that currently do not meet the risk goal (one in 100,000) would be excavated until concentrations of benzo (a) pyrene are below 2.88 mg/Kg. Soils containing Dieldrin will be remediated to below 1.53 mg/Kg.

Upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. Therefore, this constituent was not considered in the evaluation of remediation alternatives.

5.2 Off-Site Disposal

Contaminated materials within the Central West Area would be loaded into dump trucks for off-Site disposal in licensed waste disposal facilities. Erosion control materials (straw, silt fence, etc.) would be required, if soils were staged prior to final loading and transportation. Prior to transport of any materials from the site, NASA will provide to Ohio EPA the name and address of all disposal facilities and obtain acceptance for the materials to be disposed of at the facility.

Performance Standard(s):

- All excavated soils must be disposed of off-site at an appropriate waste disposal facility. Determination of the appropriate disposal facility would be based upon soil characterization data. Based upon past sampling data, all wastes would be considered solid waste.

5.3 Institutional Controls

Ohio EPA would require that an environmental covenant be recorded for the Central West Area at the time the remediation is complete to restrict use to industrial/commercial activities.

Performance Standard(s):

- An environmental covenant will be filed with the Cuyahoga County Recorder's Office within 180 days of the completion of the remedial action

restricting the use of the Central West area of the NASA facility to commercial and industrial use.

- Periodic reviews (five year reviews pursuant to CERCLA) would be conducted by Ohio EPA, to ensure that the institutional controls remain in place and that current and future owners comply with the restrictions.

6.0 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes were made from the Preferred Plan, dated February 12, 2008.

7.0 RESPONSIVENESS SUMMARY

For NASA- Glenn Research Center at Lewis Field – Central West Area
Cleveland, Cuyahoga County, Ohio

Ohio EPA received comments from interested parties during the public comment period, which ended on April 21, 2008, and at the public meeting held at the Fairview Park Branch of the Cuyahoga County Public Library, on April 14, 2008. Those comments and Ohio EPA's responses are summarized below. Remedial alternatives were evaluated to determine which of their components interested persons in the community support and have reservations about or oppose. This assessment was completed through Ohio EPA's public comment period (ending on April 21, 2008) and public hearing (April 14, 2008). During the public comment period, only one written comment was received regarding the constituents of concern and one oral comment was received during the public hearing (transcript in Appendix B).

The written comment received was from NASA Glenn regarding arsenic being included as a constituent of concern under the FS addendum. The oral comment was from a citizen who was concerned whether ground water and surface water potential contamination could impact her property. No comments were received that did not support the selected remedial alternative.

A: Written Comment:

Comment:

On March 10, 2008, Ohio EPA – Division of Emergency and Remedial Response, Northeast District Office, received NASA Glenn Research Center's written comment on the Ohio EPA – Preferred Plan for the NASA Glenn Research Center – Lewis Field's Central West Area, dated February 12, 2008. The comment states:

> "The final table in Section 9.1, titled 'Constituents of Concern Added in the FS Addendum' lists arsenic and notes that the industrial worker cleanup goal for this metal is 24.6 mg/kg. NASA believes that the inclusion of the arsenic in this table could result in a mistaken belief that NASA will be required to remediate arsenic to levels below those that are naturally occurring in soils. Therefore, NASA requests that the Ohio EPA eliminate all references to arsenic in the table."

Response:

Ohio EPA understands NASA's concern; however, for consistency with the Feasibility Study Addendum submitted by NASA, Ohio EPA cannot eliminate arsenic from the table. The Preferred Plan does state in the text of Section 9.1 under performance standards, that arsenic is consistent with background levels at the site and not included in the evaluation under the remedial alternatives. To further address NASA's concern, Ohio EPA will include a footnote to the specific table in the Decision Document to further clarify that arsenic was not included as a constituent of concern under the remedial design.

B: Oral Comment:

Comment:

On April 14, 2008, Ohio EPA held a public hearing accepting comments on the NASA Glenn Research Center at Lewis Field, Central West Area Preferred Plan. Susan Boggs, an Olmsted Township resident, provided testimony of her concerns on the Ohio EPA – Preferred Plan for the NASA Glenn Research Center – Lewis Field's Central West Area, dated February 12, 2008. Her comment concerned the potential for ground water and surface water contamination to impact shallow wells in her neighborhood along the Rocky River. Ohio EPA's understanding of her comment is the following:

> *Ms. Boggs is concerned Ohio EPA is "not considering ground water as a source of contamination due to the area surrounding NASA is a municipal water source." She is "very concerned about contamination from Hopkins International Airport and NASA Glenn being discharged into the Rocky River, which serves as a recharge zone for our (her) wells." During her testimony, she noted that the wells in her area are shallow ground water wells (about 12 feet underground) and is the only source of water available. The water is used both by humans and horses in her area. Additionally, she noted that the area is "close to a 100-year flood plain" and her ground is flooded. She also had concerns regarding wildlife and endangered species in the Metro Parks surrounding NASA Glenn and the airport and their potential exposure to "jet fuel, particulate matter, and other forms of contamination."*

Response:

First, this Preferred Plan is specific to the NASA – Glenn Central West Area located north of Cedar Point Road. The southern portion of the NASA – Glenn facility was not part of this Preferred Plan and has already been remediated under two separate Decision Documents (South 40 Transferred and South 15 Retained). Additionally, Cleveland Hopkins International Airport is not part of this Preferred Plan or the NASA Glenn site. Therefore, Ohio EPA cannot address

concerns with any of these sites under this Decision Document, since it is specific to the Central West Area of NASA - Glenn.

With respect to the statement within the comment regarding "not considering ground water" due to municipal sources of drinking water, Ohio EPA does not discount ground water solely based upon having a municipal water supply in the area. Ohio EPA is required to address all potential exposures to ground water that would include, but is not limited to, drinking, bathing, direct-contact during excavation, and impacts through migration to surface water bodies. NASA was required to conduct ground water sampling and compare their results to human health and ecological standards, to ensure that any exposure to the ground water would be safe. The ground water results were compared to the Safe Drinking Water Standards, human health risk based standards, and water quality standards for protection of wildlife along Rocky River and Abram Creek. There was one outlier result for benzene that was above drinking water standards, but this result could not be replicated and all recent sample results for ground water were below both drinking water and water quality standards. Also, NASA was required to take multiple rounds of ground water samples, to ensure that the results were accurate and representative of the site's ground water conditions during various seasons and rainfall levels. Ground water samples were collected from both shallow ground water ($\leq$ 25 feet deep) and at depth (> 25 feet) to determine impacts to both aquifers at the site. Ground water, Rocky River, and Abram Creek all flow to the north-northwest toward Lake Erie, where there is municipal water supplied to the communities of Cleveland, Fairview Park, and North Olmsted. Consideration was given to all the above information, but specifically to the sampling data that did not show any contamination levels above cleanup standards for the ground water in the NASA – Glenn Central West Area.

With respect to the concern regarding the discharges to Rocky River and potential impacts to property through flooding, Ohio EPA's selected remedy does not address continued permitted discharges to Rocky River or Abram Creek by NASA or Cleveland Hopkins, except to ensure they are in compliance with the authorized permit. The Division of Surface Water (DSW) is the permitting authority for discharging to water bodies. If the concern is related to ground water to surface water migration, again, NASA conducted ground water sampling along discharge points to the river and creek and all concentrations were found to be below water quality standards. During the remedial investigation of the Central West Area, surface water and sediment samples were collected from the Rocky River and Abram Creek, and contamination coming from NASA was not found to be contributing to the water above any water quality standards for human health or ecological exposures to the water or sediment. The one exception would be the flood plain area where the NASA firing range was previously located. An interim action was conducted to eliminate the potential for discharge of lead contamination to Abram Creek. This remedial action has been

completed prior to this Decision Document, but will be included in the Site Closure Report for the Central West Area.

OhioEPA
State of Ohio Environmental Protection Agency

PUBLIC INTEREST CENTER
P.O. Box 1049, 50 W. Town St., Suite 700
Columbus, OH 43216-1049
Tele: (614) 644-2160 Fax: (614) 644-2737

NEWS RELEASE

FOR RELEASE: April 3, 2008

CONTACT: Mike Settles
(614) 644-2160

Ohio EPA Schedules Public Meeting Concerning Cleanup Plan for NASA-Glenn Property

Ohio EPA will hold a meeting on Monday, April 14, 2008, to discuss a plan to clean up historical contamination in the central-west portion of the 364-acre NASA Glenn Research Center, located at 21000 Brookpark Road in Brook Park.

The information session and public hearing will begin at 5:30 p.m. at the Fairview Park branch of the Cuyahoga County Public Library, 21255 Lorain Road, Fairview Park.

The central-west property is the site of research facilities and wind tunnel buildings. After considering six remediation alternatives, Ohio EPA is recommending NASA excavate and remove contaminated soils from the affected area and limit future use of the property to commercial or industrial use.

At the meeting, an Ohio EPA representative will outline the proposed cleanup and citizens will have an opportunity to ask questions and voice their opinions about the preferred plan. All public comments will be considered prior to Ohio EPA's final decision on the plan.

Citizens may testify at the meeting or submit comments in writing to Ohio EPA's Northeast District Office, attn: Nancy Zikmanis, 2110 East Aurora Road, Twinsburg, 44087. Comments also may be faxed to (330) 487-0769 or e-mailed to nancy.zikmanis@epa.state.oh.us. The public comment period ends April 21, 2008.

Ohio EPA provided copies of the preferred cleanup plan and other related documents to the Fairview Park and Brook Park branches of the Cuyahoga County Public Library for public review. The materials also are available at Ohio EPA's Northeast District Office by first calling (330) 963-1200.

-30-

8.0 GLOSSARY

Aquifer - An underground geological formation capable of holding and yielding water.

ARARs - Applicable or relevant and appropriate requirements. Those statutes and rules which strictly apply to remedial activities at the site, or those statutes and rules whose requirements would help achieve the remedial goals for the site.

Baseline Risk Assessment - An evaluation of the risks to humans and the environment posed by a site.

Carcinogen - A chemical that causes cancer.

CERCLA - Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. 9601 et seq. A federal law that regulates cleanup of hazardous substances sites under the U.S. EPA Superfund Program.

Contaminants of Concern (COCs) - Chemicals identified at the site that are present in concentrations that may be harmful to human health or the environment.

Decision Document - A statement issued by Ohio EPA giving the Director's selected remedy for a site and the reasons for its selection.

Ecological Receptor - Animals or plant life exposed or potentially exposed to chemicals released from a site.

EE/CA - Engineering Evaluation/Cost Assessment. A report issued under the U.S. EPA's Superfund Accelerated Cleanup Model that evaluates remedies for a site and estimates their costs. EE/CA's are generally shorter and include fewer alternatives than Feasibility Studies.

Environmental Covenant - A servitude arising under an environmental response project that imposes activity and use limitations and that meets the requirements established in section 5301.82 of the Revised Code.

Exposure Pathway - Route by which a chemical is transported from the site to a human or ecological receptor.

Feasibility Study -	A study conducted to ensure that appropriate remedial alternatives are developed and evaluated, such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected.
Final Cleanup Levels -	Final cleanup levels are identified in the Decision Document along with the RAOs and performance standards.
Hazardous Substance -	A chemical that may cause harm to humans or the environment.
Hazardous Waste -	A waste product listed or defined by the RCRA, which may cause harm to humans or the environment.
Human Receptor -	A person or population exposed to chemicals released from a site.
Leachate -	Water contaminated by contact with wastes.
LOE Contractor -	Level of Effort Contractor. A person or organization retained by Ohio EPA to assist in the investigation, evaluation, or remediation of a site.
Maximum Contaminant Level (MCL) -	The highest level of a contaminant that is allowed in a public drinking water supply. The level is established by U.S. EPA and incorporated into OAC 3745-81-11 and 3745-81-12.
NCP -	National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300 (1990), as amended. A framework for remediation of hazardous substance sites specified in CERCLA.
O&M -	Operation and Maintenance. Long-term measures taken at a site, after the initial remedial actions, to assure that a remedy remains protective of human health and the environment.
PAHs -	Polycyclic aromatic hydrocarbons. Class of semi-volatile chemicals including multiple six-carbon rings. Often found as residue from coal-based chemical processes.
PCBs -	Polychlorinated biphenyls. An oily chemical typically used in electrical equipment.

PCE - Tetracholoethene or Perchloroethylene. A common industrial solvent and cleaner, often used for dry cleaning.

Performance Standard - Measures by which Ohio EPA can determine if RAOs have been met.

Preferred Plan - The plan that evaluates the preferred remedial alternative chosen by Ohio EPA to remediate the site in a manner that best satisfies the evaluation criteria.

Preliminary Remediation Goal (PRG) - Initial cleanup goals that (1) are protective of human health and the environment and (2) comply with ARARs. They are developed early in the process (scoping) based on readily available information and are modified to reflect the results of the baseline risk assessment (termed site-specific PRGs at this point in time). They are also used during the analysis of remedial alternatives in the remedial investigation/feasibility study (RI/FS).

RCRA - Resource Conservation and Recovery Act codified at 42 U.S.C. § 6901 et seq., as amended. A federal law that regulates the handling of hazardous wastes.

Remedial Action Objectives (RAOs) - Specific goals of the remedy for reducing risks posed by the site.

Remedial Investigation - A study conducted to collect information necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives.

Responsiveness Summary- A summary of all comments received concerning the Preferred Plan and Ohio EPA's response to all issues raised in those comments.

TCA - 1,1,1-Tricholorethane. A common industrial solvent and cleaner.

TCE - Trichloroethylene. A common industrial solvent and cleaner.

Water Quality Criteria - Chemical, physical, and biological standards that define whether a body of surface water is unacceptably contaminated. These standards are intended to ensure that a body of water is safe for fishing, swimming, and as a

drinking water source. These standards can be found in section 3745-1 of the Ohio Revised Code.

Table 3: Final Cleanup Levels:

Chemical of Concern	Industrial Worker Cleanup Goal (1 in 100,000 risk level)	Construction Worker Cleanup Goal (1 in 100,000 risk level)
Benzo(a) anthracene	28.8 mg/Kg	278 mg/Kg
• Benzo (a) pyrene	2.88 mg/Kg	27.8 mg/Kg
Dieldrin	1.53 mg/Kg	14.8 mg/Kg
Dibenzo(a,h)anthracene	2.88 mg/Kg	27.8 mg/Kg
Benzo (b)fluoranthene	28.8 mg/Kg	278 mg/Kg
Indeno(1,2,3-cd)pyrene	28.8 mg/Kg	278 mg/Kg

- *All PAH compounds in the soil will use benzo(a) pyrene as the surrogate for determining the appropriate cleanup of the Site since it is the most protective*.

Figure 1

NASA Site Map

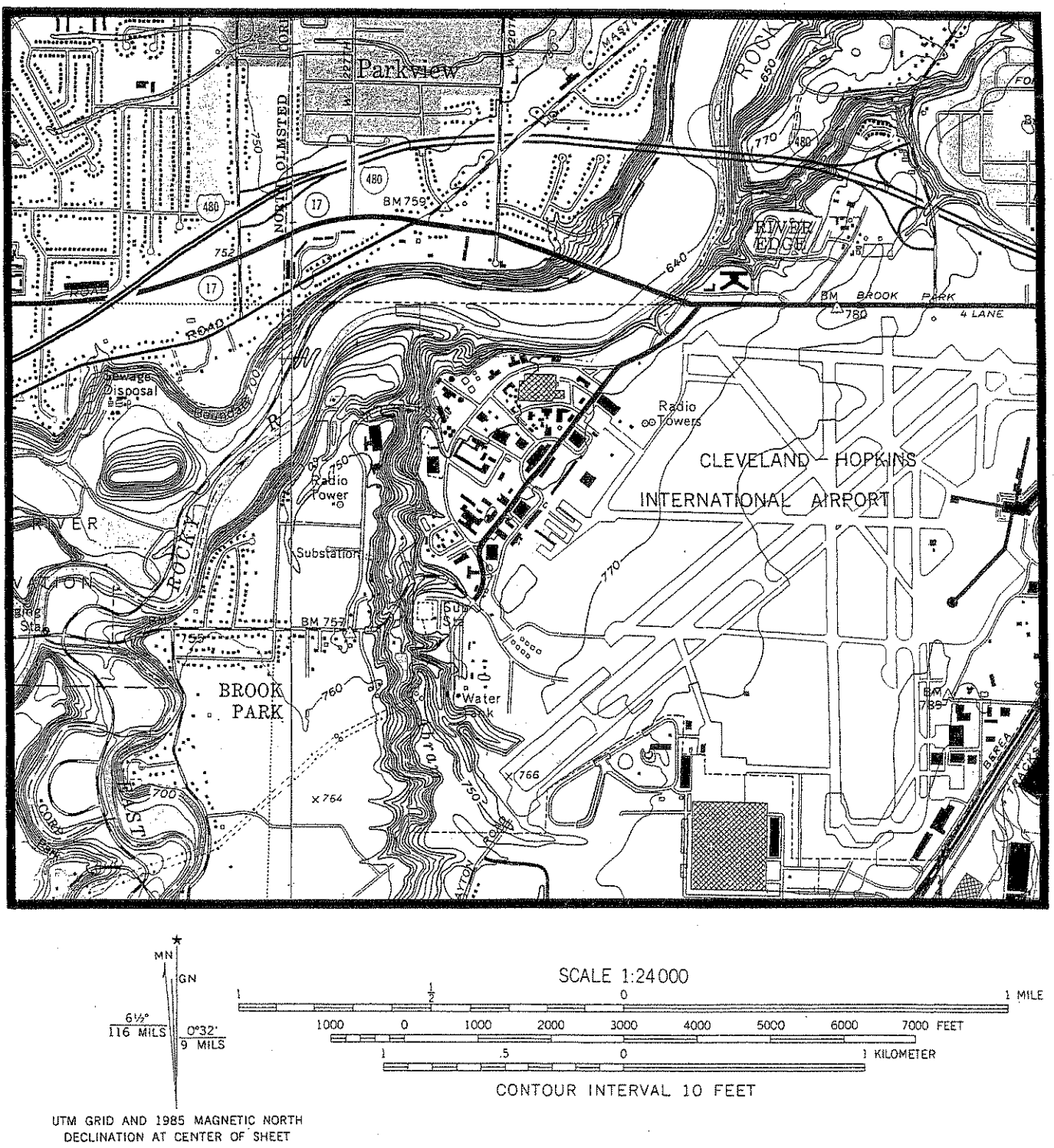
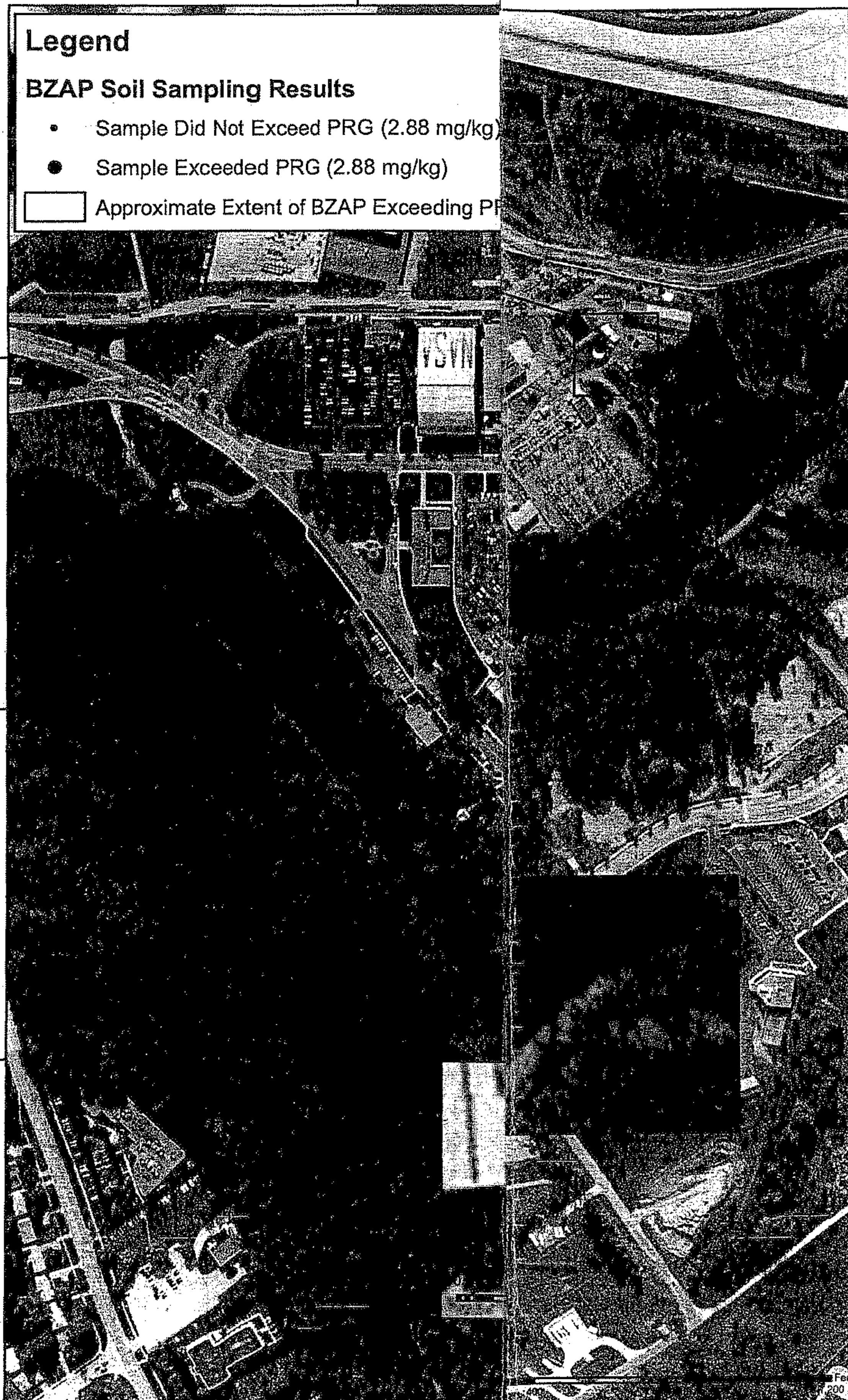


Figure 3-2 USGS Lakewood Quadrangle Map.
Source: USGS Topographic Map, Lakewood Quadrangle (Photorevised 1985), North Olmsted Quadrangle (Photorevised 1985).

Figure 2

NASA Central West Site Map



DATE 4/2/08
SCALE AS NOTED
DRAWN BY JDV

PROJECT
ADDENDUM TO
CENTRAL WEST AREA
FEASIBILITY STUDY

DRAWING TITLE
MODELED AREAS EXCEEDING
INDUSTRIAL WORKER PRGs (0-4 ft) IN
CENTRAL-WEST AREA

CLIENT
NASA GLENN RESEARCH CENTER
CLEVELAND, OHIO

SAIC Engineering of Ohio, Inc.
Twinsburg, Ohio

FIGURE 2-1

Z:\PUBLIC\N... T33 - Central-West Investigations\GIS\Figure 2-1_ModeledExtentsBZAP.mxd

Appendix A

Full Cost Estimates for Alternative from the Feasibility Study Addendum

NASA Glenn Research Center

Alternative 3 - Containment By Installation of a Cap

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2004
Total cost in FY2004$

This Central West Area Feasibility Study cost estimate is based on drawings and photographs of NASA Glenn Research Center on file at SAIC. Some features and data on the existing drawings may not be representative of actual conditions and may affect the final project costs.

Modeled Combined COC's volumes exceeding 1e -5

Modeled excavation depth	4 feet
Modeled excavation volume	320 Cubic Yards
Modeled excavation volume plus 50%	480 Cubic Yards
Modeled estimated surface area for 4 foot deep excavation	4,400 Square Feet
Modeled pavement removal and replacement area	4,400 Square Feet
Estimated time required for construction	2 Months

ASSUMPTIONS:

- Collection and disposal of stormwater is not included in this estimate.
- Building and process modifications are not included in this cost estimate.
- Modifications and excavation around existing utilities is not included.
- Groundwater will not impact the treatment area.
- No excavation or treatment will be done under existing structures.
- Soil volumes are in-situ.
- Backfill is from offsite.
- Soils loading, haul and spread volumes are equal to in place volume plus 25% swell factor.
- All work will be performed in Level D protective clothing. Hard hat, safety glasses, safety toe boots, no respirators
- Dust will be controlled using dust suppression methods.
- All vehicles, trailers, and other equipment will be relocated prior to the start of excavation.
- An earthen cap a minimum of 2 feet high plus a 5% minimum slope for drainage will cover the affected area.
- The earthen cap may block paths of egress of existing buildings and alter traffic patterns.
- Decontamination to consist of pressure washing equipment in earthwork construction area.
- Existing sites are 50% paved areas and 50% grass covered.

- Weight of excavated material	3000 lbs/cy
- Weight of backfill	3000 lbs/cy
- Weight of gravel	3000 lbs/cy

Alternative 3 - Mobilization and Demobilization

Parameters
- Construction support facilities are located on site
- Unit rates include labor, equipment, and materials.

Material	Quantity	Unit Rate	Cost
Prepare Health and Safety Plan	1	1,000	1,000
Locate and test offsite backfill soil and gravel supply			
TCLP test	2	1,500	3,000
Portable toilets, mo.	2	190	380
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo.	2	350	700
Office trailer telephone, mo.	2	100	200
Office trailer electric, mo.	2	150	300
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1500	5.80	8,700
Equipment mob/demob	1	25,000	25,000
	Total		$ 41,680

Alternative 3 - Stormwater silt control

Parameters
- Unit rates include labor, equipment, and materials cost.

Material	Quantity	Unit Rate	Cost
Silt fence, lf	1250	2	2,500
Stormwater dams, straw bales, ton	20	100	2,000
	Total		$ 4,500

Alternative 3 - Cap Preparation

Parameters

- Unit rates include labor, equipment and materials costs.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- For estimating quantities 50% of excavation area assumed to be asphalt paved and 50% grass covered
- Only pavement will be excavated, no soil removal included.

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, sy	489	6.40	3,129
Sawcut asphalt paving, 4" deep, lin ft.	300	1.86	558
Disposal TCLP testing	2	1,500.00	3,000
Hauling, 12 cy trucks, 20 mile round trip, cy	64	21.50	1,376
Disposal tipping fees, asphalt, cy	64	55.00	3,496
Loading trucks, 1.5 cy track loader, cy	64	4.83	307
Confirmation survey 3 man crew	1	1,400.00	1,400
			$ 13,265

Alternative 3 - Backfill Excavated areas

Parameters

- Unit rates include labor, equipment and materials costs.
- For estimating quantities cap construction to be 18" clay with 5% slope and 6" topsoil
- Clay volume increased 25% for cap slope requirements
- Area to be capped is 100% of total modeled area, plus 50%
- For estimating quantities cap construction under paved areas to be 18" clay plus 4" gravel, plus 4" asphalt paving
- Soil and gravel placement based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	1	3,000.00	3,000
Borrowl, clay, loaded, cy	382	8.20	3,132
Hauling, 12 cy trucks, 20 mile round trip, cy	382	21.50	8,212
Spread fill, 75 hp dozer, 50' haul, cy	382	3.37	1,287
Compaction, Ramer Tamper, 4" lifts, 3 passes, cy	31	3.74	114
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, cy	275	0.81	223
Hauling gravel base, 12 cy trucks, 20 mile round trip, cy	34	21.50	723
Spread gravel, 75 hp dozer, 50' haul, cy	34	3.37	113
Gravel, 3/4" crushed stone, placed and compacted, cy	24	3.54	86
Gravel, hand comp., Ramer Tamper, 4" lifts, 3 passes, cy	3	3.74	10
Hauling asphalt paving, 12 cy trucks, 20 mile round trip, cy	34	21.50	723
Asphalt Paving, 2" binder course, plus 2" wearing course, sy	244	8.70	2,127
Backfill, topsoil, loaded, cy	51	24.00	1,222
Hauling, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread fill, 75 hp dozer, 50' haul, cy	51	3.37	172
Hydro Seed and mulch, athletic field mix, sy	244	0.46	112
			$ 22,350

Alternative 3 - Post Construction Cleanup

Parameters

- Unit rates include labor, equipment and materials costs.

Material	Quantity	Unit Rate	Cost
Remove access control fence, lin ft.	1,500	1.25	1,875
Remove silt fence, lin ft.	1,250	1.25	1,563
			$ 3,500

Alternative 3 - COST SUMMARY - INSTITUTIONAL CONTROLS

Parameters

1. 30-year period
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis of current monitoring wells on a quarterly basis at annual cost at $25K per year..
4. Five-year reviews estimated at $125K each with six iterations.

Material	Quantity	Unit Rate	Cost
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	100,000	600,000
Five-year Reviews	6	100,000	600,000
	Total Cost for Alternative 2		$ 1,500,000

NASA Glenn Research Center

Alternative 4 - In Situ Treatment - Soil Vitrification

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2004
Total cost in FY2004$

This Central West Area Feasibility Study cost estimate is based on drawings and photographs of NASA Glenn Research Center on file at SAIC. Some features and data on the existing drawings may not be representative of actual conditions and may affect the final project costs.

Modeled Combined COC's volumes exceeding 1e -5

Modeled excavation depth	4 feet
Modeled excavation volume	320 Cubic Yards
Modeled excavation volume plus 50%	480 Cubic Yards
Surface area for 4 foot deep excavation, plus 50%	4,400 Square Feet
Modeled pavement removal and replacement area	4,400 Square Feet
Estimated time required for construction	16 Months

ASSUMPTIONS:

- Estimated time required for earthwork and treatment, and cooling - 16 months
- 12 months after final vitrification a vegetative cover will be placed over the treatment area.
- Collection and disposal of stormwater is not included in this estimate.
- Building and process modifications are not included in this cost estimate.
- Groundwater will not impact the treatment area.
- Loss of use of the treatment area for a 16 month time frame will not be a problem.
- Protection of existing utilities is not included.
- No excavation or treatment will be done under existing structures.
- All excavations will be less than 3 feet deep.
- Soil volumes are in-situ.
- Backfill is from offsite.
- Soils loading, haul and spread volumes are equal to in place volume plus 25% swell factor.
- All work will be performed in Level D protective clothing. Hard hat, safety glasses, safety toe boots, no respirators
- Dust will be controlled using dust suppression methods.
- All vehicles, trailers, and other equipment will be relocated prior to the start of excavation.
- The existing soil is suitable for the vitrification treatment process.
- Long term monitoring will not be required.
- Decontamination to consist of pressure washing equipment in earthwork construction area.
- Existing sites are 50% paved areas and 50% grass covered.

- Weight of excavated material	3000 lbs/cy
- Weight of backfill	3000 lbs/cy
- Weight of gravel	3000 lbs/cy
- expected soil shrinkage due to vitrification	20%

Alternative 4 - Mobilization and Demobilization

Parameters
- Construction support facilities are located on site
- Unit rates include labor, equipment, and materials.

Material	Quantity	Unit Rate	Cost
Prepare Health and Safety Plan	1	1,000	1,000
Locate and test offsite backfill soil and gravel supply			
TCLP test	2	1,500	3,000
Portable toilets, mo.	4	190	760
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo.	4	350	1,400
Office trailer telephone, mo.	4	100	400
Office trailer electric, mo.	4	150	600
Office trailer, delivery	2	200	400
Disconnect and remove office trailer, ea.	2	200	400
Access control fence, 4' plastic snow fence, ft.	1500	5.80	8,700
Treatability Study, ea	1	30,000	30,000
Equipment mob/demob	2	25,000	50,000
Vitrification Equipment Mob/Demob, lump	2	160,000	320,000
Permits and regulatory, lump	1	43,000	43,000
	Total		$ 461,660

Alternative 4 - Stormwater silt control

Parameters
- Unit rates include labor, equipment, and materials cost.

Material	Quantity	Unit Rate	Cost
Silt fence, lf	1250	2	2,500
Stormwater dams, straw bales, ton	20	100	2,000
	Total		$ 4,500

Alternative 4 - Excavation

Parameters

- Unit rates include labor, equipment and materials costs.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- For estimating quantities 50% of excavation area assumed to be asphalt paved and 50% grass covered
- Only pavement will be excavated, no soil removal included.

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, sy	489	6.40	3,129
Sawcut asphalt paving, 4" deep, lin ft.	300	1.86	558
Disposal TCLP testing	2	1,500.00	3,000
Hauling, 12 cy trucks, 20 mile round trip, cy	42	21.50	911
Disposal tipping fees, asphalt, ton	64	55.00	3,496
Loading trucks, 1.5 cy track loader, cy	64	4.83	307
			$ 11,400

Alternative 4 - Backfill Treated Areas

Parameters

- Unit rates include labor, equipment and materials costs.
- Area to be treated is 100% of total modeled area, plus 50%
- Soil and gravel placement based on 90% by machine and 10% by hand
- Soil cover in treated areas to be 1.5 feet of clay plus 6" topsoil to support vegetation.
- Replacement paving in treated areas to be 12" gravel, plus 4" asphalt paving

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	1	3,000.00	3,000
Borrow, clay, loaded, cy	153	8.20	1,253
Hauling, 12 cy trucks, 20 mile round trip, cy	153	21.50	3,285
Spread fill, 75 hp dozer, 50' haul, cy	153	3.37	515
Compaction, Ramer Tamper, 4" lifts, 3 passes, cy	12	3.74	46
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	110	0.81	89
			-
Hauling gravel base, 12 cy trucks, 20 mile round trip, cy	204	21.50	4,380
Spread gravel, 75 hp dozer, 50' haul, cy	204	3.37	686
Gravel, 3/4" crushed stone, placed and compacted, cy	183	3.54	649
Gravel, hand comp., Ramer Tamper, 4" lifts, 3 passes, cy	20	3.74	76
Hauling asphalt paving, 12 cy trucks, 20 mile round trip, cy	34	21.50	723
Asphalt Paving, 2" binder course, plus 2" wearing course, sy	244	8.70	2,127
Backfill, topsoil, loaded, cy	51	24.00	1,222
Hauling, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread fill, 75 hp dozer, 50' haul, cy	51	3.37	172
Hydro Seed and mulch, athletic field mix, sy	244	0.46	112
			$ 19,429

Alternative 4 - In-Situ Soil Treatment

Parameters
- Unit rates include labor, equipment and materials costs.
- Additional soil treatment cost derived from DOE and EPA WEB sites.

Material	Quantity	Unit Rate	Cost
In-Situ soil treatment, ton	720	400.00	288,000
			$ 288,000

Alternative 4 - Post Construction Cleanup

Parameters
- Unit rates include labor, equipment and materials costs.

Material	Quantity	Unit Rate	Cost
Remove access control fence, lin ft.	1,500	1.00	1,500
Remove silt fence, lin ft.	1,250	1.00	1,250
			$ 2,800

NASA Glenn Research Center

Alternative 5 - Ex-situ Treatment - High Temperature Thermal Desorption

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2004
Total cost in FY2004$

This Central West Area Feasibility Study cost estimate is based on drawings and photographs of NASA Glenn Research Center on file at SAIC. Some features and data on the existing drawings may not be representative of actual conditions and may affect the final project costs.

Modeled Combined COC's volumes exceeding 1e -5

Modeled excavation depth	4 feet
Modeled excavation volume	320 Cubic Yards
Modeled excavation volume plus 50%	480 Cubic Yards
Modeled estimated surface area for 4 foot deep excavation	4,400 Square Feet
Modeled pavement removal and replacement area	4,400 Square Feet
Estimated time required for construction	2 Months

ASSUMPTIONS:

- Collection and disposal of stormwater is not included in this estimate.
- Building and process modifications are not included in this cost estimate.
- Modifications and excavation around existing utilities is not included.
- Groundwater will not impact the treatment area.
- No excavation or treatment will be done under existing structures.
- Soil volumes are in-situ.
- Backfill is from offsite.
- Soils loading, haul and spread volumes are equal to in place volume plus 25% swell factor.
- All work will be performed in Level D protective clothing. Hard hat, safety glasses, safety toe boots, no respirators
- Dust will be controlled using dust suppression methods.
- All vehicles, trailers, and other equipment will be relocated prior to the start of excavation.
- Long term monitoring will not be required.
- Decontamination to consist of pressure washing equipment in earthwork construction area.
- Existing sites are 50% paved areas and 50% grass covered.

- Weight of excavated material	3000 lbs/cy
- Weight of backfill	3000 lbs/cy
- Weight of gravel	3000 lbs/cy

Alternative 5 - Mobilization and Demobilization

Parameters
- Construction support facilities are located on site
- Unit rates include labor, equipment, and materials.

Material	Quantity	Unit Rate	Cost
Prepare Health and Safety Plan	1	1,000	1,000
Locate and test offsite backfill soil and gravel supply			
TCLP test	2	1,500	3,000
Portable toilets, mo.	2	190	380
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	2	350	700
Office trailer telephone, mo.	2	100	200
Office trailer electric, mo.	2	150	300
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1500	5.80	8,700
Treatability Study, ea	1	30,000	30,000
Equipment mob/demob	1	25,000	25,000
HTTD Equipment Mob/Demob, lump	1	126,500	126,500
Permits and regulatory, lump	1	43,000	43,000
	Total		$ 241,180

Alternative 5 - Stormwater silt control

Parameters
- Unit rates include labor, equipment, and materials cost.

Material	Quantity	Unit Rate	Cost
Silt fence, lf	1250	2	2,500
Stormwater dams, straw bales, ton	20	100	2,000
	Total		$ 4,500

Alternative 5 - Excavation for treatment

Parameters

- Unit rates include labor, equipment and materials costs.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- For estimating quantities 50% of excavation area assumed to be asphalt paved and 50% grass covered
- Soil excavation based on 90% by machine and 10% by hand
- Soil will be excavated and transferred to an on-site treatment area.
- Maximum depth of excavation is 3 feet.

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, sy	489	6.40	3,129
Sawcut asphalt paving, 4" deep, lin ft.	300	1.86	558
Disposal TCLP testing	2	1,500.00	3,000
Hauling, 12 cy trucks, 20 mile round trip, cy	42	21.50	911
Disposal tipping fees, asphalt, ton	64	55.00	3,496
Loading trucks, 1.5 cy track loader, cy	64	4.83	307
Excavation, shallow pits, 1 cy track hoe, c.y.	432	12.88	5,564
Excavation, hand, light soil conditions, C.Y.	48	40.50	1,944
Loading trucks, 1.5 cy track loader, cy	600	3.86	2,316
Hauling, 12 cy trucks, 1 mile round trip, cy	600	4.04	2,424
Confirmation survey 3 man crew	1	1,400.00	1,400
			$ 25,049

Alternative 5 - Backfill excavated areas

Parameters

- Unit rates include labor, equipment and materials costs.
- For estimating quantities the excavated area will be backfilled with 26" clay, 6" gravel, plus 4" asphalt.
- Soil to be excavated and treated is total modeled volume plus 50%.
- Soil and gravel placement based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	1	3,000.00	3,000
Borrowl, clay, loaded, cy	441	8.20	3,619
Hauling, 12 cy trucks, 20 mile round trip, cy	441	21.50	9,489
Spread fill, 75 hp dozer, 50' haul, cy	441	3.37	1,487
Compaction, Ramer Tamper, 4" lifts, 3 passes, cy	35	3.74	132
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, cy	318	0.81	257
Hauling gravel base, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread gravel, 75 hp dozer, 50' haul, cy	51	3.37	172
Gravel, 3/4" crushed stone, placed and compacted, cy	24	3.54	86
Gravel, hand comp., Ramer Tamper, 4" lifts, 3 passes, cy	3	3.74	10
Hauling asphalt paving, 12 cy trucks, 20 mile round trip, cy	34	21.50	723
Asphalt Paving, 2" binder course, plus 2" wearing course, sy	244	8.70	2,127
Backfill, topsoil, loaded, cy	51	24.00	1,222
Hauling, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread fill, 75 hp dozer, 50' haul, cy	51	3.37	172
Hydro Seed and mulch, athletic field mix, sy	244	0.46	112
			$ 24,798

Alternative 5 - Ex-situ Soil Treatment

Parameters

- Unit rates include labor, equipment and materials costs.
- Soil treatment cost derived from Doe and EPA WEB sites.
- LTTD soil treatment cost from Means cost Data is doubled to account for higher moisture content and required higher treatment temperatures.

Material	Quantity	Unit Rate	Cost
Ex-situ soil treatment, ton	600	334.00	200,400
Loading trucks, 1.5 cy track loader, cy	600	1.53	918
Transport solid waste, (assume 60 m. trip), ton/mile	43,200	0.83	35,640
Disposal solid waste tipping fees, soil, ton	720	82.50	59,400
			$ 296,358

Alternative 5 - Post Construction Cleanup

Parameters

- Unit rates include labor, equipment and materials costs.

Material	Quantity	Unit Rate	Cost
Remove access control fence, lin ft.	1,500	1.00	1,500
Remove silt fence, lin ft.	1,250	1.00	1,250
			$ 2,800

NASA Glenn Research Center

Alternative 6 - Excavation and Off-site Disposal

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2004
Total cost in FY2004$

This Central West Area Feasibility Study cost estimate is based on drawings and photographs of NASA Glenn Research Center on file at SAIC. Some features and data on the existing drawings may not be representative of actual conditions and may affect the final project costs.

Modeled Combined COC's volumes exceeding 1e -5

Modeled excavation depth	4 feet
Modeled excavation volume	320 Cubic Yards
Modeled excavation volume plus 50%	480 Cubic Yards
Modeled estimated surface area for 4 foot deep excavation	4,400 Square Feet
Modeled pavement removal and replacement area	4,400 Square Feet
Estimated time required for construction	2 Months

ASSUMPTIONS:

- Collection and disposal of stormwater is not included in this estimate.
- Building and process modifications are not included in this cost estimate.
- Modifications and excavation around existing utilities is not included.
- Groundwater will not impact the treatment area.
- No excavation or treatment will be done under existing structures.
- Soil volumes are in-situ.
- Backfill is from offsite.
- Soils loading, haul and spread volumes are equal to in place volume plus 25% swell factor.
- All work will be performed in Level D protective clothing. Hard hat, safety glasses, safety toe boots, no respirators
- Dust will be controlled using dust suppression methods.
- All vehicles, trailers, and other equipment will be relocated prior to the start of excavation.
- Long term monitoring will not be required.
- Decontamination to consist of pressure washing equipment in earthwork construction area.
- Existing sites are 50% paved areas and 50% grass covered.

- Weight of excavated material	3000 lbs/cy
- Weight of backfill	3000 lbs/cy
- Weight of gravel	3000 lbs/cy

Alternative 6 - Mobilization and Demobilization

Parameters
- Construction support facilities are located on site
- Unit rates include labor, equipment, and materials.

Material	Quantity	Unit Rate	Cost
Prepare Health and Safety Plan	1	1,000	1,000
Locate and test offsite backfill soil and gravel supply			
TCLP test	2	1,500	3,000
Portable toilets, mo.	2	190	380
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	2	350	700
Office trailer telephone, mo.	2	100	200
Office trailer electric, mo.	2	150	300
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1500	5.80	8,700
Excavation equipment mob/demob	1	12,500	12,500
	Total		$ 29,180

Alternative 6 - Stormwater silt control

Parameters
- Unit rates include labor, equipment, and materials cost.

Material	Quantity	Unit Rate	Cost
Silt fence, lf	1250	2	2,500
Stormwater dams, straw bales, ton	20	100	2,000
	Total		$ 4,500

Alternative 6 - Excavation

Parameters

- Unit rates include labor, equipment and materials costs.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- For estimating quantities 50% of excavation area assumed to be asphalt paved and 50% grass covered
- Soil excavation based on 90% by machine and 10% by hand
- Maximum depth of excavation is 4 feet.
- Analytical indicates waste may be classified as non-hazardous solid waste

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, sy	489	6.40	3,129
Sawcut asphalt paving, 4" deep, lin ft.	300	1.86	558
Disposal TCLP testing	2	1,500.00	3,000
Hauling, 12 cy trucks, 20 mile round trip, cy	42	21.50	911
Disposal tipping fees, asphalt, ton	64	55.00	3,496
Loading trucks, 1.5 cy track loader, cy	64	4.83	307
			-
Excavation, shallow pits, 1 cy track hoe, c.y.	432	12.88	5,564
Excavation, hand, light soil conditions, C.Y.	48	40.50	1,944
Loading trucks, 1.5 cy track loader, cy	600	3.86	2,316
Hauling, 12 cy trucks, 1 mile round trip, cy	600	4.04	2,424
Confirmation survey 3 man crew	1	1,400.00	1,400
Loading trucks, 1.5 cy track loader, cy	600	1.81	1,086
Transport solid waste, (assume 60 m. trip), ton/mile	43,200	0.83	35,640
Disposal solid waste tipping fees, soil, ton	720	82.50	59,400
Confirmation survey 3 man crew	1	1,400.00	1,400
			$ 122,575

Alternative 6 - Backfill Excavated areas

Parameters

- Unit rates include labor, equipment and materials costs.
- For estimating quantities the excavated area will be covered with 18" clay, 4' gravel, plus 4" asphalt.
- Area to be excavated is assumed to be 100% of total modeled area.
- Soil and paving placement based on 90% by machine and 10% by hand
- 70% of deep excavation soil is considered non-contaminated and is reused as backfill.

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	1	3,000.00	3,000
Borrowl, clay, loaded, cy	441	8.20	3,619
Hauling, 12 cy trucks, 20 mile round trip, cy	441	21.50	9,489
Spread fill, 75 hp dozer, 50' haul, cy	441	3.37	1,487
Compaction, Ramer Tamper, 4" lifts, 3 passes, cy	35	3.74	132
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, cy	318	0.81	257
Hauling gravel base, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread gravel, 75 hp dozer, 50' haul, cy	51	3.37	172
Gravel, 3/4" crushed stone, placed and compacted, cy	24	3.54	86
Gravel, hand comp., Ramer Tamper, 4" lifts, 3 passes, cy	3	3.74	10
Hauling asphalt paving, 12 cy trucks, 20 mile round trip, cy	34	21.50	723
Asphalt Paving, 2" binder course, plus 2" wearing course, sy	244	8.70	2,127
Backfill, topsoil, loaded, cy	51	24.00	1,222
Hauling, 12 cy trucks, 20 mile round trip, cy	51	21.50	1,095
Spread fill, 75 hp dozer, 50' haul, cy	51	3.37	172
Hydro Seed and mulch, athletic field mix, sy	244	0.46	112
			$ 24,798

Alternative 6 - Post Construction Cleanup

Parameters

- Unit rates include labor, equipment and materials costs.

Material	Quantity	Unit Rate	Cost
Remove access control fence, lin ft.	1,500	1.00	1,500
Remove silt fence, lin ft.	1,250	1.00	1,250
			$ 2,800

Appendix B

Transcript from the Public Hearing – April 14, 2008

OHIO ENVIRONMENTAL PROTECTION AGENCY
PUBLIC HEARING

- - - - - - - - - - - - - - -

In Re:

NASA Glenn Research Center Lewis Field Preferred Plan for Remediation.

- - - - - - - - - - - - - - -

Transcript of proceedings before the Ohio Environmental Protection Agency, taken at Fairview Park Library, 21255 Lorain Road, Fairview Park, Ohio, on Monday, April 14, 2008, commencing at 5:30 p.m.

APPEARANCES:

Caroline Markworth, Public Involvement Coordinator and Hearing Officer

Nancy Zikmanis, Division of Emergency and Remedial Response

- - -

HEARING OFFICER MARKWORTH: The purpose of this public hearing is to accept comments on Ohio EPA's proposed preferred plan for the cleanup at the NASA Glenn central west property. Ohio EPA is recommending NASA excavate and remove contaminated soils from the affected area and limit future use of the property to commercial or industrial use.

Ohio EPA published a public notice in local newspapers regarding the preferred plan, the hearing, and the public comment period. The notice was also issued in Ohio EPA's Weekly Review, which is a publication that lists by county all agency activities and actions taking place in the State of Ohio.

Written and oral comments received as part of the official record are reviewed by Ohio EPA prior to a final action of the director. To be included in the official record, written comments must be received by Ohio EPA by the close of business on April 21, 2008. Comments received after this date may be considered as time and circumstances permit but will not be a part of the official record for this hearing.

Written comments can be filed with me

tonight or submitted to: Nancy Zikmanis, project coordinator, Ohio EPA DERR, 2110 East Aurora Road, Twinsburg, Ohio 44087. This address can also be found on the agenda.

It is important for you to know that all comments received in writing at the agency, all written comments given to me tonight, and all verbal comments given here tonight are given the same consideration.

I ask that all exhibits, including written speeches, maps, photographs, overheads, and any other physical evidence referred to in your testimony be submitted to me tonight as part of the official record. If you choose not to submit the information, Ohio EPA cannot ensure the accuracy of your testimony.

A court reporter is here to make a record of tonight's proceedings. Questions and comments made at the public hearing will be responded to in a document known as a responsiveness summary.

Recommendations of the program staff and comments presented by the public are taken into consideration before any final decisions on the preferred plan. Once a final decision is made

by the director, the decision, along with the responsiveness summary, will be communicated to all persons who have submitted comments and all persons who present testimony at tonight's hearing.

Final actions of the director are appealable to the Environmental Review Appeals Commission, ERAC. The board is separate from Ohio EPA and reviews cases in accordance with Ohio's environmental laws and rules. Any ERAC decision is appealable to Franklin County Court of Appeals. Any order of the Court of Appeals is appealable to the Supreme Court of Ohio.

If you wish to present testimony at this hearing tonight and have not already completed a blue card, please do so at this time and return it to me or an Ohio EPA representative. The cards are available at the registration table. Each individual may testify only once and speak for five minutes, so I ask that you use your time wisely, and that you are respectful of others providing their comments and questions.

There is no cross-examination of the speaker or Ohio EPA representatives in public hearings of this type. Ohio EPA's public

hearings afford citizens an opportunity to provide input. Therefore, we will not be able to answer questions during this hearing.

The hearing officer or an Ohio EPA representative may ask clarifying questions of speakers to ensure the record is as complete and accurate as possible. If you have a question, please phrase with your comments in the form of a question, and the agency will address your concerns in writing within the responsiveness summary.

Out of courtesy for elected officials here tonight, I will request they make themselves known to me at this time, and I will give them the chance to testify first. Okay. We will now receive testimony.

As I call your name, please step up to the court reporter, state your name, and spell it out for the record, and proceed with your testimony. The first person requesting to testify is Susan Boggs.

MS. BOGGS: What do I do?

SUSAN BOGGS

of lawful age, being first duly sworn, as hereinafter certified, had testified as follows:

MS. BOGGS: Susan Boggs, B-o-g-g-s, 24505 Barrett Road, Olmsted Township, Ohio 44138.

I would like to state for the record that I just want it stated that I have seen records from the Ohio EPA indicating that the area surrounding NASA Lewis, NASA Lewis or NASA Glenn Research Center, they are not considering ground water as a source of contamination due to the areas surrounding NASA is a municipal water source.

I am very concerned about contamination from Hopkins International Airport and NASA Glenn being discharged into the Rocky River, which serves as a recharge zone for our wells.

We have shallow ground water wells on our property. It is a sole source aquifer. It is the only source of water we have. We take showers with this water. We brush our teeth with this water. We cook our food with this water. We drink this water. Our wells are located about 12 feet under ground. Our water is surface water.

The property is inundated and in an area

close to a 100-year flow plain. Our ground is flooded. We have horses on our property. Our horses drink approximately 15 gallons of water a day. There is approximately 450 horses on my street.

There is wildlife, endangered species in the Metro Parks surrounding NASA Glenn and the airport, and I am just very concerned about the jet fuel, particulate matter, and other forms of contamination. I just want to state for the record we are here; we are drinking this water, and I feel that if NASA and the City of Cleveland is going to continue to discharge into the Rocky River, they have a responsibility to make sure they are not exposing people to the hazardous waste in the vicinity.

Thank you.

HEARING OFFICER MARKWORTH: Okay. Is there anyone else wishing to testify tonight?

(No response.)

HEARING OFFICER MARKWORTH: The time is now 6:19. If there are no further requests to present testimony, we will end the hearing. Remember written comments will be accepted through the close of business on April 21, 2008,

and again, these can be sent to Nancy Zikmanis, project coordinator, 2110 East Aurora Road, Twinsburg, Ohio 44087.

And this concludes today's hearing. Thank you for your testimony, cooperation, and participation in Ohio EPA's decision making process. Thank you.

(Hearing concluded at 6:20 p.m.)

- - -

State of Ohio,)
) SS:
County of Cuyahoga,)

C E R T I F I C A T E

This certifies that the foregoing is a true and correct transcript of the proceedings had before the State of Ohio, Environmental Protection Agency, at the Fairview Park Library, 21255 Lorain Road, Cleveland, Ohio, on Monday, April 14, 2008, commencing at 5:30 p.m.

In the Matter of:

NASA Glenn Research
Center Lewis Field
Preferred Plan for
Remediation.

COURT REPORTER

FINCUN-MANCINI COURT REPORTERS
1801 Ohio Savings Plaza,
17th Floor,
Cleveland, Ohio 44114
(216) 696-2272
(216) 696-2275 FAX