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DECISION DOCUMENT FOR THE REMEDIATION OF

NASA - Glenn Research Center - South 40 Area to be Retained by NASA-Glenn Research Center

***Cuyahoga* County, Ohio**

prepared by

THE OHIO ENVIRONMENTAL PROTECTION AGENCY

November 2003

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

By: _____ Date 4-4-05

DECLARATION

SITE NAME AND LOCATION

NASA - Glenn Research Center
Cleveland, Ohio

STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedial action for the NASA - Glenn Research Center - South 40 Property to be Retained by NASA - Glenn Research Center (Site) in Cleveland, Cuyahoga County, 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 benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenzo(a,h)anthracene; and indeno(1,2,3-cd)pyrene within the old landfill on the Site, if not addressed by implementing the remedial action selected in the Decision Document, constitutes a substantial threat to public health or safety and are causing or contributing to air or water pollution or soil contamination. Additionally, methane was identified in ground water monitoring wells at the Site. This was noted as a concern for construction on the landfill areas, since it was not determined whether the methane was generated by solid waste materials in the landfill or from a naturally-occurring source (shale bedrock). This was also addressed under the remedial action selected in the Decision Document.

DESCRIPTION OF THE SELECTED REMEDY

The Preferred Plan, which forms the basis for the Decision Document, is based on a Remedial Investigation (RI) and Feasibility Study (FS) prepared by NASA - Glenn Research Center and approved by Ohio EPA on September 12, 2002 with modifications. The major health and environmental risks of this Site are arsenic; aroclor 1260 (PCBs); benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenzo(a,h)anthracene; and indeno(1,2,3-cd)pyrene. Upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. Also, the PCBs identified were below the revised cleanup goal for industrial workers of 10 mg/Kg. Therefore, the only remaining chemicals of concern are the polyaromatic hydrocarbons (PAHs). However, during the RI, methane was identified in ground water monitoring wells at the Site. This was noted as a concern for construction on the landfill area, since it was not determined whether the methane was generated by solid waste

materials in the landfill or from a naturally-occurring source (shale bedrock).

All of the areas of concern are located within the old landfill at the Site. Ohio EPA's Division of Emergency and Remedial Response (DERR) requested the Division of Solid and Infectious Waste Management (DSIWM) to review the documentation on the landfill at the Site and define the applicable and relevant or appropriate solid waste requirements. Pursuant to the DSIWM's review, the landfills within the South 40 area are governed by the 1976 cap requirements, since the landfill closed prior to 1976. Also, the DSIWM noted that any hazardous substances above risk assessment levels, methane generation, leachate generation, or other extenuating circumstances may require additional measures.

Ohio EPA's preferred alternative for the Site includes the following:

- Excavation and off-site disposal of contaminated surface soils (0-2 feet) in areas which currently do not meet the cleanup goals for the Site,

- Construction of a landfill cap using the DSIWM's 1976 cap requirements for solid waste facilities and a geotexile fabric component to capture and passively disperse the methane gas, and

- An institutional control to restrict the use of the Site to industrial use.

Ohio Administrative Code (OAC) 3745-27-10 (E) and (F) as effective July 29, 1976, require three years of operation and maintenance, to ensure (1) if "settling occurs to such an extent that ponding of water occurs on the portions of the Site where waste materials are deposited, the operator, owner, or lessee shall promptly regrade the Site and/or add additional cover materials and re-seed, as necessary, to eliminate ponding," and (2) if "cracking or erosion of the cover material occurs to such an extent that water may enter the cells, the operator, owner, or lessee shall promptly regrade the Site and/or add additional cover material, and re-seed, as necessary, to eliminate the cracking and erosion." Ohio EPA may require additional operation and maintenance at the end of the three-year period, if conditions warrant extending the operation and maintenance activities.

The geotextile fabric component was added due to methane found in areas of the Old Landfills during the Remedial Investigation. Regardless of the source of the methane, a methane dispersion mechanism is necessary to accommodate the airport expansion and for the protection of human health and the environment.

Ohio EPA finds that these measures will protect public health and the environment by reducing risk to acceptable levels.

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 utilizes 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.

Christopher Jones, Director

12-2-03
Date

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DECISION DOCUMENT
for the
NASA - Glenn Research Center - South 40 Area
to be Retained by NASA - Glenn Research Center
Cuyahoga County, Ohio

1.0 SITE BACKGROUND

1.1 Site History

The NASA - Glenn Research Center (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 which 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 will be involved in the expansion of the adjacent Cleveland Hopkins International Airport (CHIA).

The surrounding area is a mixture of residential, commercial, and industrial properties. To the east and southeast of the site is Cleveland Hopkins International Airport. 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 (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 a portion of the Southern Area, or South 40 Area (Figure 2) that will be retained by NASA - Glenn as part of the NASA Facility (South 40 Area or Site). The operations in this area included propulsion research. Building 208 is a maintenance building and includes a salt dome storage area. This area also contains the newly constructed trailer row area which was used for contractor trailer storage, as well as an electrical substation (Sub A). Finally, the area has a hazardous waste (less than 90 days) storage facility. A portion of the property on which the hazardous waste storage

building is located will be transferred to Cleveland Hopkins Airport, therefore, the facility will be relocated onto property to remain with NASA - Glenn. This site will be contiguous with either the airport or other portions of the NASA - Glenn facility.

The geology of the area provides a concern, since the Southern area is bordered by a ravine and the unnamed tributary to Abram Creek. Many locations in the South 40 Area contain fill material from previous cut and fill operations. It is difficult to determine native clay material and fill materials in this area. The boundary between fill and native material was determined by drilling activities and identified by the presence of man-made material at depth and identification of fine-grained lenses. The thickness of the soil unit is variable, but has been estimated from site borings to range from 40 to 50 feet.

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), which required additional investigation. NASA - Glenn later increased the number of AOCs to 73. A Phase I Remedial Investigation/Feasibility Study (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 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.

1.2 Summary of the Remedial Investigation

The Remedial Investigation, performed by NASA - Glenn with Ohio EPA oversight, included a number of tasks to identify the nature and extent of site related chemical contaminants. The tasks included sampling of air, water, soil, surface water, sediment, and ground water. The data obtained from the investigation were used to conduct a baseline risk assessment and to determine the need to evaluate remedial alternatives. This Decision Document contains only a brief summary of the findings of the Remedial Investigation and Feasibility Study. Please refer to the RI Report and Feasibility Study for additional information on contaminant concentrations.

The nature and extent of contamination at the South 40 Area (retained by NASA) in each environmental medium and the contaminants of concern attributable to the Site are described below:

1.2.1 Soil Contamination

During the RI, 25 shallow soils samples and 69 deep soil borings were conducted in all identified areas within the South 40 Area, including the three landfills within the South 40 (Old Landfill, South 40 Landfill and the 1957 Landfill) (See Figure 3). The deep borings were installed to depths ranging from 0 to 20 feet below ground surface. The borings were installed by a drill rig in all identified areas, except the Old Landfill area around the high tension wires of Substation A (this area is not to

be part of the property transfer). These borings were installed with a geoprobe. All samples were analyzed for volatile organics, semi-volatile organics, PCBs, and metals. The RI/FS (R&R 1999b) identifies numerous "significant soil contaminants" in both surface and deep soils:

Metals: 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.

The maximum concentrations identified in the South 40 Area for each contaminant were compared to the U.S. EPA Region 9 - residential soil screening levels (SSLs), to determine if these chemicals would impact human health or ground or surface water resources. If the maximum concentration of the contaminant was found to be greater than the SSLs, additional evaluation was conducted to determine if the contaminant would leach from soil into ground water. Within the Focused FS Area, the following contaminants were found to necessitate further study for leaching:

4,4-DDT; Cadmium; Chromium; Dieldrin; Methylene chloride; Selenium; and Polyaromatic Hydrocarbons: Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoranthene; Dibenzo(a,h)anthracene; and Indeno(1,2,3-cd)pyrene.

The soil leaching study using the SESOIL® modeling computer software was developed with the contaminants cited above. 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 indicate that none of the contaminants are predicted to influence the quality of groundwater 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. This ground water sampling did occur during the remedial design phase of the South 40 Area (to transfer to CHIA) and determined that no additional ground water investigation or remediation was necessary.

The "significant soil contaminants" listed above were also evaluated in a human health risk assessment to determine the cleanup levels for constituents. Based upon the human health risk assessment levels for an industrial use scenario, the following constituents were found to be a concern in surface soils (0-2'): arsenic, polyaromatic hydrocarbons, and PCBs. In deep soils arsenic and PAHs were found at elevated levels. NASA did further background studies and research on naturally-occurring levels of arsenic and presented documentation to Ohio EPA that the levels identified at the Site were consistent with naturally-occurring arsenic levels in the background samples. Additional comparison with risk assessment-based cleanup levels showed that the PAHs in deep soils and PCBs were below the regulatory cleanup levels. Therefore, the feasibility study concludes the only soil contamination which must be addressed involves PAHs in surface soils (0 to 2') in specific areas of the South 40 Area.

1.2.2 Ground Water Contamination

During the RI, 31 groundwater monitoring wells were installed within the greater South 40 Area, ranging from 20 to 68 feet below ground level. Two groundwater zones were encountered in the greater South 40 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. Three rounds of groundwater sampling were conducted as part of the RI field activities within the South 40 Area. Two rounds were conducted during the Phase I RI, while one round was conducted in the Phase II RI. All data from the Phase I sampling was U.S. EPA contract laboratory program (CLP) data with the highest quality assurance documentation and was approved for use in the Phase II RI by Ohio EPA. The Phase II sampling was conducted after NASA - Glenn signed an Administrative Order with Ohio EPA. All groundwater wells were sampled for volatile organics, semi-volatile organics, PCBs, and metals. One exceedence for benzene was observed in the first round of ground water sampling under the Phase I RI. No exceedences of drinking water standards (maximum contaminant levels - MCLs) or risk-based cleanup standards were observed in any of the Phase II RI sampling. No further exceedences were found in the Phase II sampling events.

Further evaluation of ground water was conducted to determine impacts to surface water through ground water seeps at the South 40 ravine (See Section 1.2.3 - Surface Water Contamination).

1.2.3 Surface Water Contamination

Surface water and seeps were evaluated for impacts to the unnamed tributary which discharges to Abram Creek. Both the shallow and deep ground water zones contribute to seasonal ground water seeps with low-flows along the valley wall of the unnamed tributary. This concern was evaluated through a soil leaching study using the SESOIL® modeling computer software for the contaminants identified in Section 1.2.1. 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, to determine impacts from both the ground water seeps and overland surface water run off impacts from contaminated surface soils. Limited sediment sampling was conducted, because the unnamed tributary consists of a 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.

Upstream samples were collected to determine if storm water runoff from the Cleveland Hopkins Airport was impacting the tributary. The source of this stream is a 72-inch outfall from the airport's storm water collection system. This outfall and

a portion of the unnamed tributary will be eliminated during the runway construction by CHIA. This includes the portion of the unnamed tributary within the South 40 Area (future CHIA property).

No sediment samples showed contaminants above sediment standards. No surface water samples or seep samples had chemical concentrations above water quality standards.

Also, a screening level ecological risk assessment was completed. Analysis of the data prepared for this risk assessment led Ohio EPA to conclude that the contamination, which is impacting the unnamed tributary and Abram Creek, was from upstream sources, primarily CHIA. The risk assessment determined that the contribution to tributary contamination by NASA - Glenn is not at a level high enough to cause an adverse impact to ecological receptors in the tributary.

1.2.4 Air Releases

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 boring activities, which would be considered the worst-case construction activities, were above risk-based cleanup levels. Therefore, air release pathways are no longer a viable concern.

2.0 SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to evaluate current and future risk to ecological receptors and human health associated with contaminants present at the Site. The results demonstrated that the existing concentration of contaminants in environmental media pose risks to human receptors at a level sufficient to trigger the need for remedial action.

2.1 Risks to Human Health

The Baseline Human Health Risk Assessment (HHRA), dated August 16, 2001, concluded that several of the detected soil contaminants did not exceed acceptable risk levels. Also, no constituents in ground water exceeded drinking water standards (MCLs), except benzene, which exceeded the MCL in the first round of sampling. Analysis in three subsequent rounds of sampling determined that benzene met the MCL criteria and, therefore, benzene was eliminated from further risk consideration. The HHRA identified seven contaminants in surface soils as the contaminants which pose an unacceptable risk. The seven contaminants are: arsenic; aroclor 1260 (PCBs); benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenzo(a,h)anthracene; and indeno(1,2,3-cd)pyrene. Upon comparison with background levels of arsenic, the levels identified were found to be consistent with background metal concentrations at the Site. Also, the PCBs identified were below the revised cleanup goal for industrial workers (10 mg/Kg).

2.2 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 and Abram Creek. However, the data demonstrated that the impacts were from upstream facilities, such as CHIA. Seeps, surface water and sediments analyzed upstream, on-Site and downstream, demonstrated that the NASA facility did not exceed any ecological risk level and would not impact aquatic receptors at the Site. The area of most concern for aquatic receptors would be the unnamed tributary, which originates from a storm water outfall from CHIA and received runoff from the airport facilities and other up gradient facilities. It is CHIA's intention to eliminate the unnamed tributary by filling it in with dirt as part of the runway expansion project. Therefore, there will be no future aquatic receptors within the unnamed tributary.

The potential for terrestrial receptors (deer, birds, and plants) was also evaluated to determine if they were impacted by Site contaminants. No terrestrial receptors were found to be impacted by contamination at the NASA facility. Therefore, no additional assessment was conducted for ecological receptors at the NASA - South 40 Area.

3.0 FEASIBILITY STUDY

A Feasibility Study was conducted by NASA - Glenn in order to identify and analyze appropriate remediation alternatives. That study was conducted with oversight by Ohio EPA. The FS report was approved on September 12, 2002. The Remedial Investigation and Feasibility Study were the basis for the selection of Ohio EPA's preferred alternative.

4.0 REMEDIAL ACTION OBJECTIVES

As part of the Remedial Investigation/Feasibility Study (RI/FS) process, remedial action objectives (RAOs) were developed in accordance with the National Contingency Plan (NCP), 40 CFR Part 300, which was promulgated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended and U.S. EPA guidance. The intent of the RAOs is to set 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 a range of potential residual carcinogenic risk levels (i.e., 1 in 100,000, 1 in 1,000,000 etc.) and using a non cancer hazard index of 1.0 and a range of potential exposed receptors, i.e., direct contact with contaminated soils, inhalation and ingestion of soils.

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 for the site, this risk is in excess of the natural risk imparted to that individual by factors not related to the site. (See the South 40 Human Health Risk Assessment of March 2000 and the Focused Human Health Risk Assessment for the South 40 Area of August 2001 for further discussion of Site specific risks.)

The RAOs were developed to ensure that remedial actions reduce the projected risk to humans to acceptable levels. The United States Environmental Protection Agency (USEPA), 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 risks 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 South 40 Area (retained by NASA), the receptors found to be at risk from surface soils (zero - two feet) were the industrial worker and the construction worker. No ecological receptors were found to be at risk pursuant to the ecological baseline risk assessment and the elimination of the unnamed tributary. The area of most concern for aquatic receptors would be the unnamed tributary, which results from a storm water outfall from the CHIA and receives runoff from the airport facilities. It is CHIA's intention to eliminate the unnamed tributary by filling it in with dirt as part of the runway expansion project. Therefore, there will be no future aquatic receptors within the unnamed tributary.

The RAOs developed for the Site are detailed below:

- Remove or prevent exposure to surface soils containing concentrations of contaminants that may pose a risk to human health in excess of risk -based cleanup standards (one in 100,000 risk for Industrial use);

- Minimize the migration of soil contaminants to other environmental media (groundwater, surface water, etc.);

- Restore the Site conditions consistent with current and anticipated uses;

- Control landfill gas (methane) in landfill areas;

- Reduce leachate production; and

- Contain the solid waste.

5.0 SUMMARY OF REMEDIAL ALTERNATIVES

Six alternatives were considered in the Feasibility Study. A brief description of the major features of each of the alternatives follows. More detailed information about these alternatives can be found in the Feasibility Study.

5.1 No Action

This FS Alternative (Alternative - 1) is for no further action to be taken at the Site. Alternative - 1 would leave the South 40 Area “as is” with neither remediation nor any containment activities at the Site. Contaminated soils would remain in place at the Site. The Site would remain as it is described in the remedial investigation and human health risk assessment.

5.2 Institutional Controls

This FS Alternative (Alternative - 2) would use institutional controls (ICs) to restrict or limit human exposures to contaminated areas of the Site. ICs would include deed restrictions for land use, ground water use, and construction activities. NASA - Glenn, a government facility, is already fenced to restrict access; signs are posted which identify NASA - Glenn as a government restricted access facility. NASA also has guards which control access to NASA - Glenn and patrol the grounds.

This alternative would require no remediation of the contamination, but would limit access and activities within areas where contamination remains. All contaminants would remain in place at the Site.

5.3 Containment by Installing a Cap

This FS Alternative (Alternative - 3) would include installation of a solid waste cap (on the Old Landfill) consistent with solid waste requirements. The DSIWM review concluded that a cap consistent with 1976 rules is applicable for this Site. Any additional measures to reduce or eliminate direct contact with contaminated soils and other relevant measures

related to Site conditions would also be required. Contaminated soils would be capped using an appropriate barrier layer and drainage layer. The capping could consist of compacted soils and a geotextile fabric. Additional requirements could include a leachate collection system, methane venting system, or other solid waste requirements for landfill closure. The cap would limit exposures to the contaminants and maintenance would ensure the cap system remains in place and in good condition. This alternative would leave all contaminants in place, even those above risk-based cleanup levels, but would eliminate the exposures to humans and the environment. This alternative would require an Operation and Maintenance (O&M) plan to maintain the cap and address any leachate or potential methane issues.

5.4 In-Situ Treatment and Installation of a “1976" Cap

This 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, confirmatory sampling that all levels are below the cleanup standards, and installation of a soil cap consistent with 1976 solid waste regulations (clay/soil cap compacted to reduce infiltration rate). The cap would address any solid waste materials left in place below two feet. The selected in-situ treatment is vitrification, a thermal treatment in which electric current is used to melt soil or other earthen materials at extremely high temperatures in order to destroy soil contaminants. The treatment would only be conducted for contaminated soils above risk-based cleanup standards within the top two feet of the ground surface. Once the treatment is completed, sampling of residuals and the landfill area would be conducted. Any material above cleanup standards within the top two feet would be disposed of off-Site in an appropriate waste facility. A “1976" cap would be placed over the treated area, since solid waste would potentially be left in place below the two feet of contaminated soils to be remediated. The cap would consist of two feet of compacted soils to prevent surface water infiltration into underlying materials. In addition to the soil cap, a geotextile fabric would be installed below the soil for dispersion of potential methane, which may be generated by naturally occurring shales or solid waste materials at the Site. This alternative would reduce contaminant levels to below risk-based cleanup standards consistent with future use of the Site through treatment and restrict exposures by use of a cap. Any future intrusive activities would necessitate an authorization to dig, excavate, etc., under OAC 3745-27-13 (Solid Waste regulations). No operation and maintenance plan would be required, however, since the landfill would meet the risk-based cleanup standards.

5.5 Ex-Situ Soil Treatment, Off-Site Disposal, and Installation of a Cap

This 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, replacement of the treated materials and installation of a soil cap consistent with current solid waste regulations (clay/soil cap compacted to reduce infiltration rate). The selected ex-situ treatment is high temperature thermal desorption, a physical separation process which uses one of two systems - rotary dryer or thermal screw. Both systems would require an air pollution control system for particulate and off-gas materials. The

treatment would only be conducted for contaminated soils above risk-based cleanup standards within the top two feet of the ground surface. Once the treatment is completed, sampling of residuals and the landfill area would be conducted. Any material above cleanup standards would be disposed of off-Site in an appropriate waste facility. Finally, since treated and untreated solid waste would potentially be left in place and waste materials placed into the landfill, this would be considered creation of a new landfill and the cap would be subject to current OAC 3745-27-11 closure requirements. This alternative would reduce contaminant levels to below risk-based cleanup standards consistent with future use of the Site through treatment and would restrict exposures by use of a cap. However, 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. Finally, the Solid Waste closure requirements for a newly created landfill are more stringent and would require 30 years post closure care.

5.6 Excavation of Contaminated Material, Off-Site Disposal, and Installation of a “1976" Cap

This FS Alternative (Alternative - 6) would include excavation of all soils above risk-based cleanup standards and installation of a solid waste cap consistent with “1976" solid waste requirements. The excavation of soils would only include contaminated soils above risk-based cleanup standards within the top two feet of the ground surface. All excavated soils would be disposed off-Site in a licensed solid waste facility. Once soils are excavated, confirmation samples would be collected, to ensure removal of any soils in the top two feet above cleanup standards. Finally, a “1976" cap would be placed over the landfill area, since solid waste would potentially be left in place below the two feet of contaminated soils to be remediated. The cap would consist of two feet of compacted soils to prevent surface water infiltration into underlying materials. In addition to the soil cap, a geotextile fabric would be installed below the soil for dispersion of potential methane, which could be generated by naturally occurring shales or solid waste materials at the Site. This alternative would remove all soils with contaminant levels above risk-based cleanup standards consistent with future use of the Site, and would restrict exposures to solid waste materials by use of a soil cap. Additionally, OAC 3745-27-10 (E) and (F) as effective July 29, 1976, require three years of operation and maintenance to ensure that (1) if “settling occurs to such an extent that ponding of water occurs on the portions of the Site where waste materials are deposited, the operator, owner or lessee shall promptly re grade the Site and/or add additional cover materials and re-seed as necessary to eliminate ponding,” and (2) if “cracking or erosion of the cover material occurs to such an extent that water may enter the cells, the operator, owner, or lessee shall promptly re grade the Site and/or add additional cover material, and re-seed as necessary to eliminate the cracking and erosion.” Ohio EPA may require additional operation and maintenance at the end of the three-year period if conditions warrant extending the operation and maintenance activities. No operation and maintenance plan would be required, since the landfill will meet the risk-based cleanup standards; however, the landfill could still contain some solid waste materials after the treatment and, therefore, would be subject to solid waste regulation under OAC 3745-27-13. Any future intrusive activities would necessitate an authorization to dig, excavate, etc., under OAC 3745-27-13 (Solid Waste Regulations).

6.0 COMPARISON AND EVALUATION OF ALTERNATIVES

6.1 Evaluation Criteria

In selecting the remedy for this Site, Ohio EPA considered the following eight criteria as outlined in USEPA's National Contingency Plan (NCP) promulgated under CERCLA (40 CFR 300.430):

1. Overall protection of human health and the environment - Alternatives shall be assessed 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 by eliminating, reducing, or controlling exposures to levels established during development of remediation goals.

2. Compliance with ARARS - Addresses whether or not 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 - Refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once pollution has been abated and cleanup goals 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.

4. Reduction of toxicity, mobility, or volume through treatment - The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume shall be assessed, including how treatment is used to address the principal threats posed by the site.

5. Short-term effectiveness - The short-term impacts of alternatives shall be assessed considering 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 - The ease or difficulty of implementing the alternatives shall be assessed by considering the following types of factors as appropriate: (1) Technical feasibility, including 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); (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 availability of prospective technologies.

7. Cost - The types of costs that shall be assessed include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operation and maintenance costs (O&M); and (3) Net present value of capital and O&M costs.

8. Community acceptance - This assessment includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. This comment period ended March 10, 2003. See the Responsiveness Summary on Page 31.

The first two are threshold criteria required for acceptance of an alternative as both accomplishing the goal of health and environmental protection and complying with the law. The next five are the balancing criteria that were used to select the alternative identified in the Preferred Plan. The cost estimates were based on figures provided by the FS. Those estimates include only the direct costs of implementing the selected remedy at the Site and do not include other costs, such as damage to the environment or human health associated with any alternative. Community acceptance was determined, in part, by written responses received during the public comment period and statements offered at the public meeting.

6.2 Analyses of Evaluation Criteria

The section examines how each of the evaluation criteria is applied to each of the Remedial Alternatives found in Section 5.0 and compares how the alternatives achieve the criteria.

6.2.1 Overall Protection of Human Health and the Environment

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 upperbound excess lifetime cancer risk to an individual of between one in 10,0000 and one in 1,000,000, and the total noncarcinogenic adverse health effects be estimated using a hazard index less than 1.0. For the South 40 Area (retained by NASA), a risk of one in 100,000 with an industrial only use was determined to be the acceptable criteria. This was determined since the Site will be used for NASA research, maintenance activities, and chemical storage, which is considered an industrial property use. Also, NASA will place a deed restriction on the Site to restrict the Site to an industrial use in the future.

Adverse impacts to ecological receptors are identified as a hazard quotient and, when appropriate, a hazard index value greater than 1.0. The ecological screening risk assessment did not identify any potential receptors. However, full attainment of the appropriate water quality criteria was also evaluated in the feasibility study for ground water seeps, which may impact a surface water body. Based upon the soil leaching model, ground water contamination to seeps should not impact the unnamed tributary above water quality standards.

Alternative	Risk Remaining After Remediation	Soils Meet Remediation Goal (10^{-5} Industrial)
1 - No Action	Contaminated soils above risk goals still in place; no barrier to restrict contact and migration.	NO
2 - Institutional Control	Contaminated soils above risk goals still in place; however, a deed restriction to limit actions which could result in direct contact with soils.	NO, but contact prohibited
3 - Capping	Contaminated soils above risk goals still in place; however, installation of a physical barrier to restrict direct contact by receptors and migration of contaminants.	NO, but contact restricted
4 - In-situ Treatment and Capping	Contaminated soils treated to below risk goals and physical barrier to restrict direct contact and migration of remaining contaminants.	YES
5 - Ex-situ Treatment and and Capping	Contaminated soils treated to below risk goals and physical barrier to restrict direct contact and migration of remaining contaminants.	YES
6 - Excavation and Capping	Contaminated soils removed to levels below risk goals and physical barrier to restrict direct contact and migration of remaining contaminants.	YES

6.2.2 Compliance with Applicable Requirements

Alternative 1 is not protective of human health and the environment and, therefore, does not meet the requirements of the Administrative Order.

Alternative 2 is not protective of human health and the environment and, therefore, does not meet the requirements of the Administrative Order.

Alternative 3 would comply with all applicable, relevant, and appropriate requirements, if the appropriate landfill design is implemented. The landfill construction must follow all applicable solid waste requirements, surface water regulations, air emissions regulations, and remedial requirements pursuant to the Administrative Order.

Alternative 4 would comply with all applicable, relevant, and appropriate requirements, as long as all required permits were obtained for the treatment technology and capping. Additionally, the final design would need to meet the requirements of the Administrative Order and applicable, relevant, and appropriate requirements.

Alternative 5 would comply with all applicable, relevant, and appropriate requirements, as long as all required permits were obtained for the treatment technology and capping. Additionally, the final design would need to meet the requirements of the Administrative Order and applicable, relevant, and appropriate requirements.

Alternative 6 would comply with all applicable, relevant, and appropriate requirements. Additionally, the final design would need to meet the requirements of the Administrative Order and applicable, relevant, and appropriate requirements.

6.2.3 Long-Term Effectiveness and Permanence

Alternative 1 has no long term effectiveness or permanence, since no action to remediate the risk would be performed. Alternative 2 has limited long-term effectiveness, since this alternative would only limit the activities on-Site by legal instruments. These institutional controls must remain in place and persons working at the Site must be aware of these restrictions for them to be effective. In Alternative 3, long-term effectiveness would also be limited, since the contamination would still be in place. The capping of this material would reduce direct exposure; however, if this cap is disturbed, the risk of direct contact by on-site workers is a concern. Therefore, the long-term effectiveness of Alternative 3 would be achieved as long as the operation and maintenance of the cap is sustained.

Alternatives 4, 5 and 6 have high long-term effectiveness and permanence, since the contaminated soils above risk cleanup goals, within the top two feet of the ground surface, would be remediated either by treatment or excavation. Alternatives 4 and 5 may be less effective if treatment of the materials is not fully completed and residuals remain in the treated area. Alternative 6 is the most

permanent remedy, since contaminated materials above risk cleanup goals would be fully removed from the Site.

6.2.4 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 all consist of treatment or removal to either reduce toxicity or eliminate the volume of the contaminated materials. Alternatives 4 and 5 would use in-situ and ex-situ treatment systems to reduce the toxicity of the contaminants through thermal treatment. These treatments could leave residual materials on-Site, and the treatment system would need to be monitored for potential air emissions from the superheating of the contamination. However, the cap would reduce surface water infiltration, thereby, reducing the mobility to the ground water of any contaminants left in place.

Alternative 6 is the best alternative under this criteria, since all contamination above risk cleanup goals would be removed and no elevated toxicity would remain above industrial standards consistent with proposed future use. Additionally, the cap would reduce surface water infiltration, thereby, reducing the mobility to the ground water of any remaining contaminants.

6.2.5 Short-Term Effectiveness

Alternative 1 has no short term effectiveness, since no action to remediate the risk would be performed. Alternative 2 has short- term effectiveness, since this alternative would only limit the activities on-Site by legal instruments. These institutional controls must remain in place and persons working at the Site must be aware of these restrictions for them to be effective. However, during the period prior to implementing these controls, this alternative shows no effectiveness as a remedy.

Alternative 3 would protect on-Site workers and visitors by implementation of Health and Safety Plan requirements for the duration of the remedial work to be conducted.

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 generate some short-term issues.

6.2.6 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 and keeping the restrictions in place for the future if ownership of the property is transferred.

Alternative 3 is implementable by NASA; however, it could generate implementation issues. The site would require post closure care requirements to be maintained and followed through an Operation and Maintenance Agreement with Ohio EPA.

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, the treated soils may not be appropriate for airport runway construction. Also, it is unknown at this time if this treatment would be successful and, therefore, may require additional treatment or measures to ensure protectiveness.

Alternative 5 is implementable by NASA. The treatment technology is commercially available and, based upon currently known Site conditions, the technology is appropriate. However, special considerations under design development or construction may need to be considered, although this is not expected to impede the implementability.

Alternative 6 is implementable at the Site. All equipment and qualified operators are readily available. Special considerations, due to relocation construction of NASA facilities, would be easier to accommodate under this alternative.

Alternative	Estimated Time to Complete

1 - No Action	Immediate
2 - Inst. Controls	30 years to indefinite (keep restrictions)
3 - Cap	6 month treatment + 3 years of O&M
4 - In-Situ & Cap	10 months treatment with cooling period + 3 years of O&M
5 - Ex-Situ & Cap	11 months + 3 years of O&M
6 - Excavation & Cap	6 months + 3 years of O&M (no plan)

6.2.7 Cost

Below is a breakdown of costs of each alternative, including the cost of implementing the remedy, post remedial costs for operation and maintenance (O&M) and five year reviews required by CERCLA, and contingency and indirect costs. (See Appendix A - Full Cost Estimates for Alternatives.) For additional detail on the cost estimates, please review the "CERCLA Feasibility Study at the NASA Glenn Research Center Pertaining to Property Within the Greater South 40 Area to be Retained by NASA," dated April 2002, Appendix B of the Feasibility Study.

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; the relatively small volume of contaminated soils make this alternative much more practical, since it could be directly loaded onto trucks and shipped off-site in a less cost prohibitive manner.

Remedial Cost Development (FY $2000)

Alternative	Design Implement Cost	Post Remedial Cost (O&M/5 yr. Reviews)	Contingency Costs and Indirect Costs	Total Cost of Remedy
1 - No Action	$0.00	$0.00	$0.00	**$0.00**
2 - Institutional Controls	$1,120,000	$000, 000	$439,000	**$1,559,000**
3 - Capping	$1,822936	$2,475,000	$3,177,064	**$7,475,000**
4 - In-Situ Treatment and "1976" Cap	$2,028,047	Post Closure Care costs not included	$1,501,953	**$3,530,000**
5 - Ex-Situ Treatment and "1976" Cap	$2,001,842	Post Closure Care costs not included	$1,481,158	**$3,483,000**
6 - Excavation and Cap	$1,804,613	Post Closure Care costs not included.	$1,335,387	**$3,140,000**

6.2.8 Community Acceptance

Ohio EPA did not received any comments from interested parties during the public meeting held at the Brook Park City Council chambers on February 19, 2003. One comment was received through electronic mail on February 26, 2003. This comment and Ohio EPA's response are included in the Responsiveness Summary.

Please note that the comment refers to the activities for the Cleveland Hopkins Airport Expansion and not activities summarized in this Decision Document.

7.0 SELECTED REMEDIAL ALTERNATIVE

The selected remedial alternative is a combination of Alternatives 2 and 6. Ohio EPA agrees with the excavation and capping alternative (Alternative 6) for remediation of the contaminated soils at the Site. Although additional requirements to address methane accumulation issues and impacts to the cap, pursuant to facility construction, will be addressed, it is not known if the methane is being generated from solid waste materials within the landfill or is naturally occurring due to the oil shales below the Site. Due to the proposed remediation goal as an industrial use, a deed restriction is necessary to enforce the industrial use restriction at the Site. No operation and maintenance plan would be required, since the alternative meets the risk remediation goals for the Site. However, the

Site will be subject to three years of operation and maintenance requirements to ensure that (1) if "settling occurs to such an extent that ponding of water occurs on the portions of the Site where waste materials are deposited, the operator, owner, or lessee shall promptly re grade the Site and/or add additional cover materials and re-seed as necessary to eliminate ponding" and (2) if "cracking or erosion of the cover material occurs to such an extent that water may enter the cells, the operator, owner, or lessee shall promptly re grade the Site and/or add additional cover material, and re-seed as necessary to eliminate the cracking and erosion, a deed restriction limiting the property to industrial use only, and five year reviews to ensure that the institutional controls remain in effect. The cap would be subject to OAC 3745-27-13, if the cap would be disturbed.

7.1 Soil Excavation

Contaminated materials within the South 40 Area (retained by NASA) would be excavated using standard construction equipment and loaded into dump trucks for off-Site disposal. Erosion control materials (straw, silt fence, etc.) would be required if soils were staged prior to final loading and transportation. Soil characterization would be completed for proper disposal; however, previous Site data does not indicate the materials would be hazardous wastes. A health and safety plan would be developed and implemented to ensure worker safety while excavation is completed.

<u>Performance Standard(s)</u>

- Soils that are above the risk remediation goals for industrial use, carcinogenic and noncarcinogenic, must be excavated and properly disposed. 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.

- Since all five PAHs are co-located with, and in lesser concentrations than Benzo(a) Pyrene, it would be used as the surrogate for cleanup. Benzo (a) Pyrene is considered the most potent of the PAHs found at the Site and has the lowest cleanup standard. Therefore, all areas of soil contamination that currently do not meet the risk goals (e.g., carcinogenic at 1 in 100, 000) would be excavated until concentrations of Benzo (a) Pyrene meet the cleanup standard (i.e., 2.9 mg/kg).

- Confirmatory samples must be collected within the excavated area to demonstrate that each area meets risk remediation goals for industrial use, carcinogenic and non-carcinogenic.

7.2 Off-Site Disposal

Contaminated materials within the South 40 Area (retained by NASA) would be loaded into dump trucks for off-Site disposal. Erosion control materials (straw, silt fence, etc.) would be required, if soils were staged prior to final loading and transportation. Samples would be collected to determine compliance with the acceptance criteria for the proposed disposal facility.

Performance Standard(s)

- All excavated soils must be disposed of off-Site at an appropriate licensed and/or permitted waste facility. Determination of the appropriate disposal facility would be completed based upon soil characterization data.

7.3 Installation of “1976" Landfill Cap

NASA would conduct confirmational sampling in excavated areas, which would be only a portion of the landfill area, to demonstrate that all areas meet the cleanup standard for Benzo (a) Pyrene (i.e., 2.9 mg/kg). Once this demonstration is completed, a landfill cap meeting the Solid Waste requirements and guidance for a “1976" cap would be constructed over the entire landfill area. The capping would require a minimum of two feet of well-compacted clay materials meeting a standard of 10^{-5} permeability (per Solid Waste Guidance). Ohio EPA would further require that, due to methane generation identified during the remedial investigation well sampling, a geotextile fabric, which could passively disperse gases, be installed below the two feet of compacted soils. Also, a marker layer would be required above the cap location, to denote the location of the landfill.

Performance Standard(s)

- Landfill cap must be installed over the entire defined landfill area (Old Landfill) in compliance with Solid Waste “1976" cap requirements and guidance. (See Appendix B - Solid Waste guidance on “1976" capping). Additionally, Ohio EPA requires a geotextile layer below the two feet of soil to passively disperse any methane gases which may be generated by the landfill area and a marker layer above the two feet of cap to denote its location.

7.4 Institutional Controls

Ohio EPA would require that a deed restriction be placed on the South 40 Area (to be Retained by NASA), to restrict use to industrial activities, and to ensure that no excavation of basement structures occurs within the landfill limits.

Performance Standard(s)

- A deed restriction, pre-approved by Ohio EPA's Legal Office, must be recorded upon approval by Ohio EPA of the Construction Completion Report for this portion of the property. Record the approved deed restriction with the Cuyahoga County recorder, prohibiting the excavation of basement structures within the landfill limits and restricting the South 40 Area (to be retained by NASA) to industrial use only. The performance standard shall be achieved upon recording of the deed restriction and its continued enforcement.

8.0 GLOSSARY

Aquifer -	An underground geological formation capable of holding and yielding water.
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. A federal law that governs clean up of hazardous substance sites under the Superfund Program.
Decision Document -	A statement issued by the Ohio Environmental Protection Agency giving the Director's selected remedy for a site and the reasons for its selection.
Ecological Receptor -	Animals or plant life exposed to chemicals released from a site.
Exposure Pathway -	Route by which a chemical is transported from a 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 alternatives can be presented to a decision-maker and an appropriate remedy selected.
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 exposed to chemicals released from a site.
Leachate -	Water contaminated by contact with wastes.
NCP -	National Contingency Plan. A framework for remediation of hazardous substance sites specified in CERCLA.

O&M -	Operation and Maintenance. Those 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.
PAH's -	Polynuclear aromatic hydrocarbons. Class of chemicals including multiple six-carbon rings. Often found as residue from coal-based chemical processes.
PCB's -	Polychlorinated biphenyls. An oily chemical typically used in electrical equipment.
Preferred Plan -	The plan chosen by Ohio EPA to remediate the site in a manner that best satisfies the evaluation criteria.
RCRA -	Resource Conservation and Recovery Act. A federal law that regulates the handling of hazardous wastes.
Remedial Action Objectives -	Specific goals of the remedy for reducing risks posed by the site.
Remedial Investigation -	An investigation 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 public comments received concerning the Preferred Plan and Ohio EPA's response to those comments.
Water Quality Criteria -	Chemical and thermal 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.

RESPONSIVENESS SUMMARY

For NASA - Glenn Research Center - South 40 - Property to be Retained by NASA, Cuyahoga County, Ohio

The public comment period for the preferred plan was from February 19, 2003 through March 10, 2003. The public hearing occurred on February 19, 2003. Ohio EPA received one (1) written comment on the preferred plan and recorded no (0) testimonies at the public meeting (see transcript received February 28, 2003).

The following is a resource list of the written comment received by Ohio EPA's Division of Emergency and Remedial Response, Northeast District Office:

- H. Paul Binder, Councilman, City of Olmsted Falls, dated February 26, 2003 (received through electronic mail at Northeast District Office).

Written Comment:

- *"It is my understanding that the Ohio EPA has still not issued a 401 Permit, after Director Jones relented on the EPA's decision not to issue the required permit, and issued a 'waiver,' which was determined not to [be] in the scope of his authority and improper by the EPA Review Committee.*

  *Therefore the Army Corp of Engineers' issuance of it's 404 Permit was impro*per *because it was based on the Ohio EPA's improper issuance of a waiver.*

  Because these projects appear related it would seem prudent for the Ohio EPA, in exercising it's responsibility in holding public hearings, to insure that the 401 Permit requirement has been fulfilled before addressing further issues.

  Has the required 401 Permit been issued, or even requested since this EPA Review Committee's determination that the original waiver was improper?"

Ohio EPA' s Response: This project is specific to Ohio EPA's Administrative Order with NASA - Glenn Research Center for remediation of the NASA - Glenn facility. The remediation of this property does not require a Clean Water Act Section 401 Water Quality Certification or a Section 404 Dredge/Fill Permit, since no dredging, filling, or other impact to a surface water body will need to occur to complete the remedy. Please note, activities associated with the filling of the unnamed tributary and Abram Creek are outside the scope of this remedial project and on property adjacent to this project, not the subject property.

APPENDIX A

Full Cost Estimates for Alternatives

NASA Glenn Research Center

Brook Park, Ohio

Focused Feasibility Study Cost Estimate

(FY $2000)

ACTIVITY	Alternative 2 Institutional Controls	Alternative 3 Containment By Installation of a Cap	Alternative 4 In-Situ Treatment - Soil Vitrification	Alternative 5 Ex-Situ Soil Treatment and Off-site disposal	Alternative 6 Excavation and Off-site Disposal
Mobilization and Demobilization	N/A	$ 23,640	$ 208,800	$ 216,360	$ 23,640
Stormwater silt control	N/A	$ 4,200	$ 4,200	$ 4,200	$ 4,200
Excavation	N/A	N/A	$ 39,398	$ 28,787	$ 32,362
Cap Preparation	N/A	$ 40,780	N/A	N/A	N/A
Backfill	N/A	$ 20,816	$ 6,257	$ 14,253	$ 10,911
Soil Treatment	N/A	N/A	$ 35,892	$ 4,742	N/A
Cap Installation	N/A	$ 612,500	$ 612,500	$ 612,500	$ 612,500
Post Construction Cleanup	N/A	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Institutional Controls	$ 1,120,000	$ 1,120,000	$ 1,120,000	$ 1,120,000	$ 1,120,000
Operation and Maintenance	N/A	$ 2,475,000	N/A		
Subtotal	$ 1,120,000	$ 4,297,936	$ 2,028,047	$ 2,001,842	$ 1,804,813
Remediation Costs Contingency 25%	$ -	$ 1,075,000	$ 508,000	$ 501,000	$ 452,000
Total Remediation Costs Year 2000 dollars	$ 1,120,000	$ 5,373,000	$ 2,537,000	$ 2,503,000	$ 2,257,000
Total Remediation Costs Current	$ 1,199,000	$ 5,750,000	$ 2,715,000	$ 2,679,000	$ 2,415,000
Indirect Costs (20% of Remediation Costs)	$ 239,800	$ 1,150,000	$ 543,000	$ 535,800	$ 483,000
Indirect Contingency Costs (10% of Remediation Costs)	$ 119,900	$ 575,000	$ 271,500	$ 267,900	$ 241,500
Total Project Costs	$ 1,559,000	$ 7,475,000	$ 3,530,000	$ 3,483,000	$ 3,140,000

1. The Contingency and the Total With Contingency Items are rounded to the closest thousand.
2. Indirect costs are a function of the Total Remediation Costs and are estimated to cover legal fees, engineering and design expenses, and inital costs after remediation.

NASA Glenn Research Center

Alternative 2 - Institutional Controls

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2000
Total cost in FY2000$

This Focused Feasibility Study cost estimate is based on drawings and photographs of NASA Glen 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 $1x10^{-5}$ $ILCR_{Industrial}$

Modeled Excavation depth 0 feet

Modeled Excavation Volume 0 Cubic Yards

ASSUMPTIONS:

1. 30-year period
2. Establishment of the ICs with a one-time establishment cost.
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis is an annual cost at $20K per year.
4. Five-year reviews estimated at $100K each with six iterations.

Alternative 2 - COST SUMMARY - INSTITUTIONAL CONTROLS

Material	Quantity	Unit Rate	Cost
Establish ICs	1	100,000	100,000
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	20,000	120,000
Five-year Reviews	6	100,000	600,000
	Total Cost for Alternative 2		$ 1,120,000

NASA Glenn Research Center

Alternative 3 - Containment By Installation of a Cap

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2000
Total cost in FY2000$

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

Modeled Combined COC's volumes exceeding $1x10^{-5}$ $ILCR_{industrial}$

Modeled Excavation depth	2	feet
Modeled Excavation Volume	10	Cubic Yards
Modeled Estimated Area	152,420	Square Feet
Modeled Estimated Contamination Area	140	Square Feet
Estimated time required for construction	3	Months

ASSUMPTIONS:

- Collection and disposal of stormwater is not included in this estimate.
- Changes to the existing surface stormwater modifications are not included in this cost estimate.
- Building and process modifications are not included in this cost estimate.
- Groundwater will not impact the treatment area.
- 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.
- An earthen cap 2 feet high will cover the affected area.
- The earthen cap may block paths of egress of existing buildings.

- 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	4	1,000	4,000
Portable toilets, mo.	3	180	540
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	3	250	750
Office trailer telephone, mo.	3	100	300
Office trailer electric, mo.	3	150	450
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1000	4.20	4,200
Equipment mob/demob	1	10,000	10,000
	Total		$ 23,640

Alternative 3 - Stormwater silt control

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

Material	Quantity	Unit Rate	Cost
Silt fence, lf	2000	2	4,000
Stormwater dams, straw bales, ton	2	100	200
	Total		$ 4,200

Alternative 3 - Cap Preparation

Parameters
- Unit rates include labor, equipment and materials costs.
- Soil will be excavated from around buildings and under paved areas and transferred to an on-site treatment area.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- Area to be capped is 90% of total modeled area.
- Soil excavation based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, s.y.	1,778	6.30	11,200
Sawcut asphalt paving, lin ft.	400	1.16	464
Disposal TCLP testing	1	1,000.00	1,000
Hauling, 12 cy trucks, 10 mile round trip, cy	296	13.30	3,941
Disposal tipping fees, ton	444	50.00	22,222
Loading trucks, 1.5 cy track loader, cy	296	1.53	453
Confirmation Sampling			-
Confirmation survey 3 man crew	1	1,500.00	1,500
			$ 40,780

Alternative 3 - Backfill Excavated areas

Parameters
- Unit rates include labor, equipment and materials costs.
- For estimating quantities cap construction to be 18" clay plus 6" topsoil.
- Area to be capped is 90% of total modeled area, plus an additional 20% added for overlap at perimeter
- Soil and gravel placement based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	2	3,000.00	6,000
Backfill, clay, loaded, cy	11	7.20	81
Hauling, 12 cy trucks, 10 mile round trip, cy	11	13.30	150
Spread fill, 130 hp dozer, 300' haul, c.y.	11	2.26	25
Compaction, Ramer Tamper, 4" lifts, 3 passes, C.Y.	2	3.68	6
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	11	0.64	7
Backfill, topsoil, loaded, cy	4	16.05	60
Hauling, 12 cy trucks, 10 mile round trip, cy	4	13.30	50
Spread fill, 130 hp dozer, 300' haul, c.y.	4	2.26	8
Hydro Seed and mulch, athletic field mix, s.y.	20,323	0.71	14,429
			$ 20,816

Alternative 3 - "1976" Landfill Cap

Estimates based on US EPA sources as cited in the FS. Values for a RCRA Subtitle D Cap were used to develop the "1976" cap estimate.

Material	Quantity	Unit Rate	Cost
"1976" Landfill Cap	4	175,000.00	612,500
			$ 612,500

Alternative 3 - Post Construction Cleanup

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

Material	Quantity	Unit Rate	Cost
Remove access control fence	1,000	1.00	1,000
			$ 1,000

Alternative 3 - INSTITUTIONAL CONTROLS / FIVE-YEAR REVIEWS

Parameters

1. 30-year period
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis is an annual cost at $20K per year. Accounts for 31 current monitoring wells sampled on a quarterly basis.
4. Five-year reviews estimated at $100K each with six iterations.

Material	Quantity	Unit Rate	Cost
Establish ICs	1	100,000	100,000
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	20,000	120,000
Five-year Reviews	6	100,000	600,000
	Total Cost for Alternative 2		$ 1,120,000

Alternative 3 - Post-Remedial Action Operation & Maintenance

Parameters
1. 30-year period

Element	Quantity	Unit Rate	Cost
Monitoring, Sampling, Testing, and Analysis			
* Explosive Gas Monitoring	30	5,000	150,000
* Site Monitoring			
- Groundwater Monitoring	30	10,000	300,000
- Soil Sampling	30	10,000	300,000
* Health and Safety Monitoring	30	5,000	150,000
Contingency	30	10,000	300,000
Cap Maintenance			
* Quarterly Inspections	120	2,500	300,000
* Cap Maintenance	120	2,500	300,000
Professional Services			
* Project Management	30	10,000	300,000
* Legal Support	30	2,500	75,000
* Technical Support	30	10,000	300,000
			$ 2,475,000

NASA Glenn Research Center

Alternative 4, In Situ Treatment - Soil Vitrification

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2000
Total cost in FY2000$

This Focused Feasibility Study cost estimate is based on drawings and photographs of NASA Glen 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 $1x10^{-5}$ $ILCR_{industrial}$

Modeled Excavation depth	2	feet
Modeled Excavation Volume	10	Cubic Yards
Modeled Estimated Area	152,460	Square Feet
Modeled Estimated Contamination Area	140	Square Feet
Estimated time required for construction	10	Months

ASSUMPTIONS:

- Estimated time required for earthwork and treatment, and cooling - 22 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.
- Changes to the existing surface stormwater modifications are not included in this cost 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 22 month time frame will not be a problem.
- Existing paved areas will be gravel paved and made ready for future development.
- 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.

- 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	4	1,000	4,000
Portable toilets, mo.	10	180	1,800
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	10	250	2,500
Office trailer telephone, mo.	10	100	1,000
Office trailer electric, mo.	10	150	1,500
Office trailer, delivery	2	200	400
Disconnect and remove office trailer, ea.	2	200	400
Access control fence, 4' plastic snow fence, ft.	1000	4.20	4,200
Treatability Study, ea	1	30,000	30,000
Equipment mob/demob	2	10,000	20,000
Vitrification Equipment Mob/Demob, lump	1	140,000	140,000
	Total		$ 208,800

Alternative 4 - Stormwater silt control

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

Material	Quantity	Unit Rate	Cost
Silt fence, lf	2000	2	4,000
Stormwater dams, straw bales, ton	2	100	200
	Total		$ 4,200

Alternative 4 - Excavation and Consolidation

Parameters
- Unit rates include labor, equipment and materials costs.
- Soil will be excavated from around buildings and under paved areas and transferred to an on-site treatment area.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- Soil to be excavated is estimated to be 65% of total modeled area.
- Soil excavation based on 90% by machine and 10% by hand
- Treatment Area is estimated to be 25% of modeled area.

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, s.y.	1,222	6.30	7,700
Sawcut asphalt paving, lin ft.	400	1.16	464
Disposal TCLP testing	1	1,000.00	1,000
Hauling, 12 cy trucks, 10 mile round trip, cy	204	13.30	2,709
Disposal tipping fees, ton	306	50.00	15,278
Excavation, trenches, 1 cy track hoe, difficult cond., c.y.	6	4.75	28
Excavation, hand, heavy soil conditions, C.Y.	1	70.00	46
Loading trucks, 1.5 cy track loader, cy	8	1.53	12
Hauling, 12 cy trucks, 1 mile round trip, cy	8	3.67	30
Spread fill, end loader, c.y.	8	4.52	6,899
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	7	0.64	733
Water truck, 3000 gal, rental, mo.	1	3,000.00	3,000
Confirmation Sampling			-
Confirmation survey 3 man crew	1	1,500.00	1,500
			$ 39,398

Alternative 4 - Backfill Excavated areas

Parameters
- Unit rates include labor, equipment and materials costs.
- For estimating quantities area covered with 18" soil and 6" gravel in existing paved areas.
- Soil to be backfilled is assumed to be 65% of total modeled area.
- Modeled areas not excavated will receive the excavated material or is under existing structures.
- Soil and gravel placement based on 90% by machine and 10% by hand
- Treatment area is estimated to be 25% of modeled area.

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	2	3,000.00	6,000
Backfill, clay, loaded, cy	6	7.20	44
Hauling, 12 cy trucks, 10 mile round trip, cy	6	13.30	81
Spread fill, end loader, c.y.	6	4.52	28
Compaction, Ramer Tamper, 4" lifts, 3 passes, C.Y.	0	3.68	2
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	4	0.64	3
Hauling gravel, 12 cy trucks, 10 mile round trip, cy	2	13.30	27
Spread fill, end loader, c.y.	2	4.52	9
Gravel, 3/4" crushed stone, placed and compacted, cy	1	43.00	63
Gravel, 3/4" crushed stone, hand compacted, cy	0	3.68	1
			$ 6,257

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.
- Treatment area is estimated to be 25% of modeled area.
- Soil cover of 1.5 feet of clay plus 6" topsoil necessary to support vegetation. Assume 10,000 s.f. coverage area.

Material	Quantity	Unit Rate	Cost
In-Situ soil treatment, ton	15	375.00	5,625
Water truck, 3000 gal, rental, mo.	2	3,000.00	6,000
Backfill, clay, loaded, cy	694	7.20	5,000
Hauling, 12 cy trucks, 10 mile round trip, cy	694	13.30	9,236
Spread fill, 130 hp dozer, 300' haul, c.y.	694	2.26	1,569
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	556	0.64	356
Backfill, topsoil, loaded, cy	231	16.05	3,715
Hauling, 12 cy trucks, 10 mile round trip, cy	231	13.30	3,079
Spread fill, 130 hp dozer, 300' haul, c.y.	231	2.26	523
Hydro Seed and mulch, athletic field mix, s.y.	1,111	0.71	789
			$ 35,892

Alternative 4 - "1976" Landfill Cap

Estimates based on US EPA sources as cited in the FS. Values for a RCRA Subtitle D Cap were used to develop the "1976" cap estimate.

Material	Quantity	Unit Rate	Cost
1976 Landfill Cap	4	175,000.00	612,500
			$ 612,500

Alternative 4 - Post Construction Cleanup

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

Material	Quantity	Unit Rate	Cost
Remove access control fence	1,000	1.00	1,000
			$ 1,000

Alternative 4 - Five Year Reviews / Institutional Controls

1. 30-year period
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis is an annual cost at $20K per year. Accounts for 31 current monitoring wells sampled on a quarterly basis.
4. Five-year reviews estimated at $100K each with six iterations.

Material	Quantity	Unit Rate	Cost
Establish Institutional Controls	1	100,000	100,000
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	20,000	120,000
Five-year Reviews	6	100,000	600,000
			$ 1,120,000

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

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2000
Total cost in FY2000$

This Focused Feasibility Study cost estimate is based on drawings and photographs of NASA Glen 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 $1x10^{-5}$ $ILCR_{Industrial}$

Modeled Excavation depth	2	feet
Modeled Excavation Volume	10	Cubic Yards
Modeled Estimated Surface Area	152,460	Square Feet
Modeled Estimated Contamination Area	140	Square Feet
Estimated time required for construction	7	Months

ASSUMPTIONS:

- Estimated time required for earthwork and treatment - 7 months
- Collection and disposal of stormwater is not included in this estimate.
- Changes to the existing surface stormwater modifications are not included in this cost estimate.
- Building and process modifications are not included in this cost estimate.
- Groundwater will not impact the treatment area.
- Existing paved areas will be gravel paved and made ready for future development.
- 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.
- Long term monitoring will not be required.
- Decontamination to consist of pressure washing equipment in earthwork construction area.

- 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	4	1,000	4,000
Portable toilets, mo.	7	180	1,260
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	7	250	1,750
Office trailer telephone, mo.	7	100	700
Office trailer electric, mo.	7	150	1,050
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1000	4.20	4,200
Treatability Study, ea	1	30,000	30,000
Equipment mob/demob	1	10,000	10,000
HTTD Equipment Mob/Demob, lump	1	120,000	120,000
Permits and regulatory, lump	1	40,000	40,000
	Total		$ 216,360

Alternative 5 - Stormwater silt control

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

Material	Quantity	Unit Rate	Cost
Silt fence, lf	2000	2	4,000
Stormwater dams, straw bales, ton	2	100	200
	Total		$ 4,200

Alternative 5 - Excavation for treatment

Parameters
- Unit rates include labor, equipment and materials costs.
- Soil will be excavated from around buildings and under paved areas and transferred to an on-site treatment area.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- Soil to be excavated is assumed to be 90% of total modeled area.
- Soil excavation based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, s.y.	1,222	6.30	7,700
Sawcut asphalt paving, lin ft.	400	1.16	464
Disposal TCLP testing	1	1,000.00	1,000
Hauling, 12 cy trucks, 10 mile round trip, cy	204	13.30	2,709
Disposal tipping fees, ton	306	50.00	15,278
Excavation, trenches, 1 cy track hoe, difficult cond., c.y.	6	4.75	29
Excavation, hand, heavy soil conditions, C.Y.	1	70.00	63
Loading trucks, 1.5 cy track loader, cy	8	1.53	13
Hauling, 12 cy trucks, 1 mile round trip, cy	8	3.67	31
Confirmation Sampling			-
Confirmation survey 3 man crew	1	1,500.00	1,500
			$ 28,787

Alternative 5 - Backfill excavated areas

Parameters
- Unit rates include labor, equipment and materials costs.
- For estimating quantities area covered with 18" soil plus 6" gravel in existing paved areas.
- For estimating quantities 65% of area is gravel covered
- Soil to be excavated and treated is assumed to be 90% of total modeled area.
- Soil and gravel placement based on 90% by machine and 10% by hand
- Treated soil is used as backfill.

Material	Quantity	Unit Rate	Cost
Water truck, 3000 gal, rental, mo.	2	3,000.00	6,000
Spread fill, end loader, c.y.	8	4.52	38
Compaction, Ramer Tamper, 4" lifts, 3 passes, C.Y.	1	3.68	3
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	8	0.64	5
Hauling gravel, 12 cy trucks, 10 mile round trip, cy	2	13.30	27
Spread fill, end loader, c.y.	2	4.52	9
Gravel, 3/4" crushed stone, placed and compacted, cy	1	43.00	63
Gravel, 3/4" crushed stone, hand compacted, cy	0	3.68	1
Backfill, topsoil, loaded, cy	231	16.05	3,715
Hauling, 12 cy trucks, 10 mile round trip, cy	231	13.30	3,079
Spread fill, 130 hp dozer, 300' haul, c.y.	231	2.26	523
Hydro Seed and mulch, athletic field mix, s.y.	1,111	0.71	789
			$ 14,253

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	15	310.00	4,650
Treated soil, loaded, cy	8	7.20	61
Hauling, 12 cy trucks, 1 mile round trip, cy	8	3.67	31
Confirmation Sampling			-
			$ 4,742

Alternative 5 - "1976" Landfill Cap

Estimates based on US EPA sources as cited in the FS. Values for a RCRA Subtitle D Cap were used to develop the "1976" cap estimate.

Material	Quantity	Unit Rate	Cost
1976 Landfill Cap	4	175,000.00	612,500
			$ 612,500

Alternative 5 - Post Construction Cleanup

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

Material	Quantity	Unit Rate	Cost
Remove access control fence	1,000	1.00	1,000
			$ 1,000

Alternative 4 - Five Year Reviews / Institutional Controls

1. 30-year period
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis is an annual cost at $20K per year. Accounts for 31 current monitoring wells sampled on a quarterly basis.
4. Five-year reviews estimated at $100K each with six iterations.

Material	Quantity	Unit Rate	Cost
Establish Institutional Controls	1	100,000	100,000
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	20,000	120,000
Five-year Reviews	6	100,000	600,000
			$ 1,120,000

Alternative 6, Excavation and Off-site Disposal

BASIS OF ESTIMATE:

Construction costs are derived from Means Cost Data 2000
Total cost in FY2000$

This Focused Feasibility Study cost estimate is based on drawings and photographs of NASA Glen 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 $1x10^{-5}$ $ILCR_{industrial}$

Modeled Excavation depth	2	feet
Modeled Excavation Volume	10	Cubic Yards
Modeled Estimated Surface Area	152,460	Square Feet
Modeled Estimated Contamination Area	140	Square Feet
Estimated time required for construction	3	Months

ASSUMPTIONS:

- Collection and disposal of stormwater is not included in this estimate.
- Changes to the existing surface stormwater modifications are not included in this cost estimate.
- Building and process modifications are not included in this cost estimate.
- Groundwater will not impact the treatment area.
- Existing paved areas will be gravel paved and made ready for future development.
- 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.
- Long term monitoring will not be required.
- Decontamination to consist of pressure washing equipment in earthwork construction area.

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

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	4	1,000	4,000
Portable toilets, mo.	3	180	540
Office trailer utility connections	2	1,000	2,000
Office trailer w/aircond., no hookups, mo	3	250	750
Office trailer telephone, mo.	3	100	300
Office trailer electric, mo.	3	150	450
Office trailer, delivery	1	200	200
Disconnect and remove office trailer, ea.	1	200	200
Access control fence, 4' plastic snow fence, ft.	1000	4.20	4,200
Equipment mob/demob	1	10,000	10,000
	Total		$ 23,640

Alternative 6 - Stormwater silt control

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

Material	Quantity	Unit Rate	Cost
Silt fence, lf	2000	2	4,000
Stormwater dams, straw bales, ton	2	100	200
	Total		$ 4,200

Parameters

- Unit rates include labor, equipment and materials costs.
- Soil will be excavated from around buildings and under paved areas and transferred to an on-site treatment area.
- Paved areas are assumed to be 5" bituminous material on a non contaminated gravel base.
- Soil to be excavated is assumed to be 90% of total modeled area.
- Soil excavation based on 90% by machine and 10% by hand

Material	Quantity	Unit Rate	Cost
Pavement removal, 5" thick, s.y.	1,222	6.30	7,700
Sawcut asphalt paving, lin ft.	400	1.16	464
Disposal TCLP testing	2	1,000.00	2,000
Hauling, 12 cy trucks, 10 mile round trip, cy	204	13.30	2,709
Disposal tipping fees, asphalt, ton	306	50.00	15,278
Excavation, trenches, 1 cy track hoe, difficult cond., c.y.	8	4.75	38
Excavation, hand, heavy soil conditions, C.Y.	1	70.00	63
Loading trucks, 1.5 cy track loader, cy	11	1.53	17
Transport solid haz. Waste, ton/mile (assume 60 m.)	608	1.65	1,002
Disposal haz. waste tipping fees, soil, ton	10	157.00	1,590
Confirmation Sampling			-
Confirmation survey 3 man crew	1	1,500.00	1,500
			$ 32,362

Alternative 6 - Backfill Excavated Areas

Parameters

- Unit rates include labor, equipment and materials costs.
- For estimating quantities 65% of the area will be covered with 18" clay plus 6" gravel in existing paved areas.
- For estimating quantities all areas not paved will receive 18" clay followed by 6" topsoil.
- Area to be excavated is assumed to be 90% of total modeled area.
- 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
Backfill, clay, loaded, cy	11	7.20	81
Hauling, 12 cy trucks, 10 mile round trip, cy	11	13.30	150
Spread fill, 130 hp dozer, 300' haul, c.y.	11	2.26	25
Compaction, Ramer Tamper, 4" lifts, 3 passes, C.Y.	1	3.68	3
Compaction, Vibrating sheepsfoot, 6" lifts, 3 passes, C.Y.	8	0.64	5
Hauling gravel, 12 cy trucks, 10 mile round trip, cy	2	13.30	27
Spread fill, 130 hp dozer, 300' haul, c.y.	2	2.26	5
Gravel, 3/4" crushed stone, placed and compacted, cy	1	43.00	63
Gravel, 3/4" crushed stone, hand compacted, cy	0	3.68	1
Backfill, topsoil, loaded, cy	1	16.05	18
Hauling, 12 cy trucks, 10 mile round trip, cy	1	13.30	15
Spread fill, 130 hp dozer, 300' haul, c.y.	1	2.26	2
Hydro Seed and mulch, athletic field mix, s.y.	10,588	0.71	7,517
			$ 10,911

Alternative 5 - 1976 Landfill Cap

Estimates based on US EPA sources as cited in the FS. Values for a RCRA Subtitle D Cap were used to develop the "1976" cap estimate.

Material	Quantity	Unit Rate	Cost
1976 Landfill Cap	4	175,000.00	612,500
			$ 612,500

Alternative 6 - Post Construction Cleanup

Parameters

- Unit rates include labor, equipment and materials costs.

Material	Quantity	Unit Rate	Cost
Remove access control fence	1,000	1.00	1,000
			$ 1,000

Alternative 6 - Five Year Reviews / Institutional Controls

1. 30-year period
2. Management Plan updates are performed once every five years, therefore, 6 iterations
3. Sampling and Analysis is an annual cost at $20K per year. Accounts for 31 current monitoring wells sampled on a quarterly basis.
4. Five-year reviews estimated at $100K each with six iterations.

Material	Quantity	Unit Rate	Cost
Establish Institutional Controls	1	100,000	100,000
Prepare/update Health and Safety Plan	6	10,000	60,000
Prepare/update Management Plan	6	40,000	240,000
Sampling and Analysis	6	20,000	120,000
Five-year Reviews	6	100,000	600,000
			$ 1,120,000

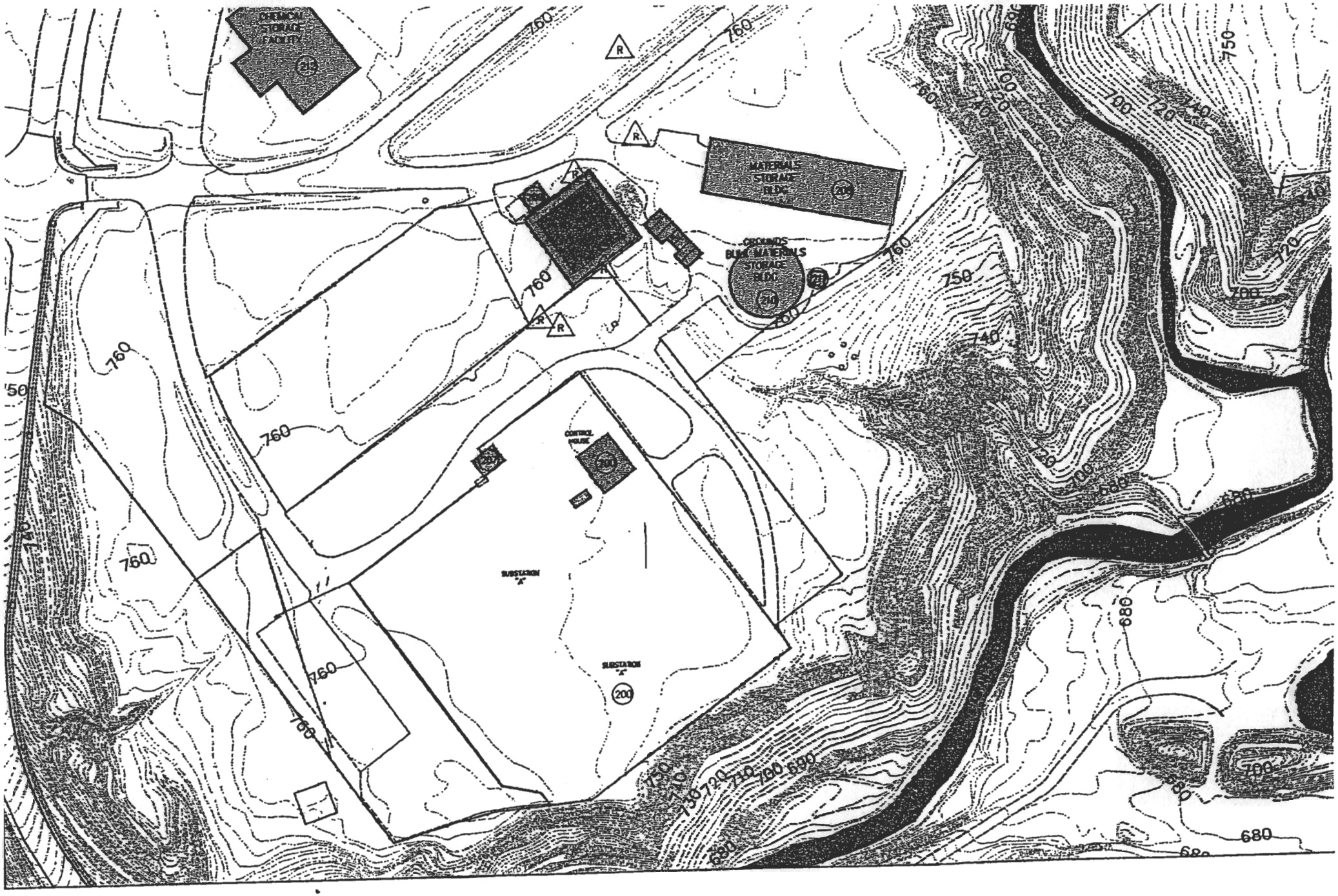

Fig. 2 - Retained Property - South 40

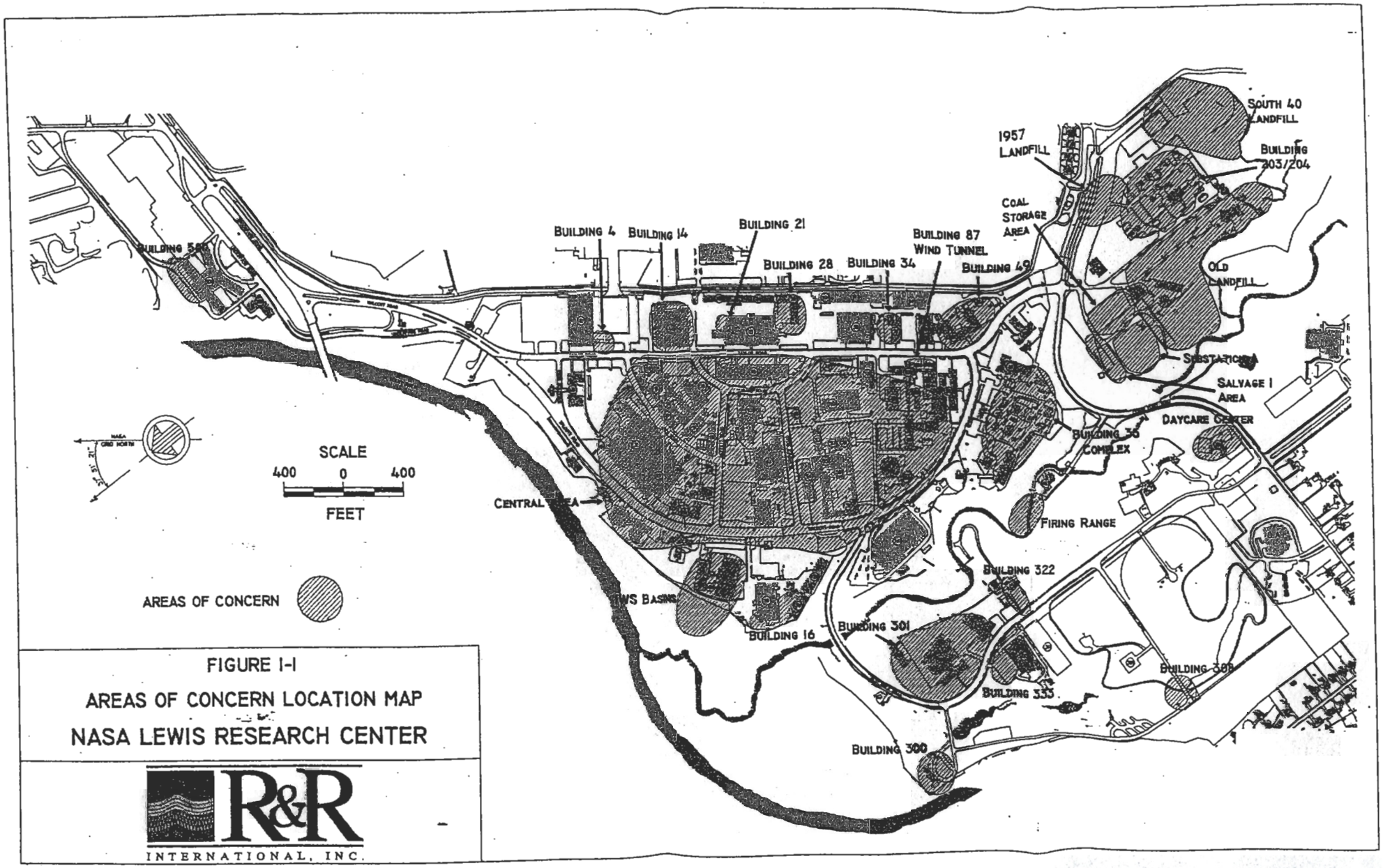

FIGURE I-I

AREAS OF CONCERN LOCATION MAP

NASA LEWIS RESEARCH CENTER

R&R INTERNATIONAL, INC.

APPENDIX B

Solid Waste Guidance on "1976" Capping

Ohio EPA - DSIWM GUIDANCE
(614) 644-2621
FAX: (614) 728-5315

SUBJECT: Standards for Current Construction of a 1976 Cap System

GUIDANCE #: 0123

REFERENCE: OAC 3745-27-09(F) [Effective 7/29/76]

CROSS REFERENCES: Measurable Criteria for Questionable Pre-1990 Landfill Caps (3/24/95)

DATE: March 27, 1995
(Supersedes document of same title dated 6/9/93)

TOTAL # OF PAGES: 4

I. Purpose:

The purpose of this document is to interpret Ohio Administrative Code (OAC) 3745-27-10 [effective 7/29/76] to establish criteria for material, construction, and testing specifications for the construction of a 1976 cap (or a modified version) today. It is necessary for OEPA to be consistent statewide on specifications we require for the construction of a 1976 cap and also be within the language of the 1976 rules. It would be unreasonable and unlawful for OEPA to establish criteria through this document that could be construed to increase or decrease the standard of the 1976 rules.

II. Applicability:

This document establishes criteria for materials, construction and testing specifications; for the building of a new cap that meets the requirements of the 1976 rules, or the rebuilding of an old cap which failed to meet the 1976 rules.

III. Background:

It is DSIWM's position that facilities which have failed to initiate or complete closure or which closed improperly are liable for compliance with current closure and post-closure regulations. However, settlement negotiations for specific enforcement cases have resulted in orders requiring the owner/operator of a previously, but improperly closed solid waste landfill to complete installation of a final cap system meeting the requirements of OAC Rule 3745-27-10 (or a modified version), as that rule was effective July 29, 1976 (1976 cap).

Material specifications and construction and testing criteria for a 1976 cap are not nearly as detailed as those set forth in the 1990 regulations [OAC 3745-27-11(G)] or the 1994 regulations [OAC 3745-27-08(C)(15) and (C)(16)].

A guidance document titled "Measurable Criteria for Questionable Pre-1990 Landfill Caps," dated March 24, 1995, establishes criteria to be used in testing a previously installed 1976 cap for compliance with applicable standards. However, the March 24, 1995 document does not address material, construction, and testing specifications for installation of a 1976 cap (or modified version) today. This document supplements the March 24, 1995, guidance to establish these installation criteria.

This guidance document has updated the previous format of the previous interoffice communication; no other substantial changes have been made.

IV. Procedure:

Material Specifications:

The soil material specifications for a 1976 cap are not dependent upon whether the cap is currently being constructed or is already existing and undergoing testing for compliance with the 1976 rules. Therefore, the same material specifications established in the mARCH 24, 1995 guidance on testing a questionable cap will be used to determine the suitability of material for construction of a 1976 cap today. These specifications are:

- 100% of the material particles must pass a 10" screen, with no more than two (2) particles from a 50 cubic foot sample retained on a 6" screen;
- 95% of the material particles must pass a 3" screen;
- 70% of the material particles must pass the #10 sieve;
- The material that passes the #10 sieve (sand, silt, and clay fractions) must be classified using the USDA textural classification chart, and be a soil type listed in OAC 3745-27-09(F)(4), as effective July 29, 19976, or an acceptable alternative soil type as allowed by that rule.

NOTE: The testing frequency established in the March 24, 1995, guidance for an existing cap (i.e., one test pit per acre) corresponds to one "sampling" for every approximately 3,000 cubic yards of material. Therefore, a representative sample of the material intended for use in construction should be evaluated at a frequency not less than once for every 3,000 cubic yards.

Evaluation of the representative samples should include all particle size determinations except those utilizing the 10" and 6" screens. Use of these larger screens is not necessary unless visual observation of the material results in concerns that the 10" and/or 6" particle size criteria will not be met. If screening for 10" and 6" particle sizes is deemed necessary, one representative sample of at least 50 cubic feet should be tested for each 3,000 cubic yards of material intended for use to verify that the large particle size criteria are met.

Construction Specifications:

The 1976 rules specify that the final cover layer must be well compacted and have low permeability to water, good compactability, and cohesiveness. Although these terms are not quantified in the 1976 rules, with this document DSIWM will establish compaction and permeability criteria for a newly constructed 1976 cap.

Common construction practice, whether for roadways, earthen dams, subgrades, etc., requires that earthen construction materials be well compacted to minimize the potential for failure due to settlement, loading, etc. Construction specifications typically include the requirement to compact the materials to at least 95% of the maximum Standard Proctor Density (ASTM D-698) or 90% of the maximum Modified Proctor Density (ASTM D-1557). These same compaction criteria are included in Ohio's 1994 regulations for the recompacted soil liner and cap barrier layer and will be adopted as the compaction standard for construction of a 1976 cap. To achieve the required compaction rate, the material should be compacted using loose lifts, no greater than 8 inches thick prior to compaction.

In order to quantify the term "low permeability to water," it is important to consider the dual purpose of the 1976 cap as both a barrier layer to infiltration and to provide nourishment and support for a healthy and dense vegetative cover. As noted on Page 3 of the March 24, 1995 guidance, it would not be reasonable to expect the 1976 cap, with its dual purpose role, to have permeability criteria equivalent to the recompacted soil barrier layer in the 1994 cap systems. The Subtitle D closure requirements (40 CFR Part 258.60), which became effective October 9, 1991, require the installation of an "infiltration layer" which has permeability no greater than 1×10^{-5} cm/sec. When consideration is given to the lack of any substantive or detailed construction or testing requirements in the 1976 regulations, it is unreasonable to believe that many, if any, pre-1990 final covers (1976 caps) obtained field permeabilities in the range of 1×10^{-7} cm/sec. Most 1976 caps were likely much more permeable than 1×10^{-7} cm/sec. For these reasons, Ohio EPA will adopt 1×10^{-5} cm/sec as the maximum allowable field permeability for newly constructed 1976 caps. This permeability criteria should not be applied to the testing of existing 1976 caps. Their compliance with the 1976 regulations should be judged solely on the testing protocol and criteria outlined in the March 24, 1993 guidance document.

Testing Specifications:

The criteria to judge the suitability of soils for use in constructing a 1976 cap are listed in the "Material Specifications" section above. The suitability of the soils should be determined prior to their intended use in cap construction. The following tests should be performed on representative soil samples at least once for every 3,000 cubic yards of material intended for use.

- The sample should be screened to remove any particles larger than 3 inches;
- Sieve and hydrometer testing (ASTM D-422) for particle size gradation;
- Moisture/density relationship using either Standard Proctor (ASTM D-698) or Modified Proctor (ASTM D-1557) method.

Results of this testing should be made available to the local Ohio EPA District Office at least seven days prior to its intended use in cap construction.

During construction of the cap, compaction must be monitored to ensure that the proper specifications are met. This can be accomplished by a number of methods, including nuclear densimeter (ASTM D-2922), sand cone (ASTM D-1556), and rubber balloon (ASTM D-2167). The nuclear densimeter test, if used, should be performed at least five times per acre per lift. The sand cone or rubber balloon methods should be performed at least three times per acre per lift. The sampling rate for other methods must be determined on an individual basis.

Upon completion of construction, the permeability of the cap must be determined. This can be accomplished through either field permeability testing (Boutwell two-stage permeameter, SDRI) or through laboratory testing of cap samples brought to the lab for analysis (Shelby tubes, soil blocks). The permeability requirements for each type of permeability determination are as follows:

- For field permeability tests (Boutwell, SDRI), the required permeability of the cap is 1×10^{-5} cm/sec.
- For laboratory permeability tests (Shelby tubes, soil blocks), the required permeability of the cap is 1×10^{-6} cm/sec.

Any penetrations into the cap layer resulting from either compaction or permeability testing should be repaired using bentonite or a bentonite/soil mixture.

V. Point of Contact:

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