NASA LEWIS RESEARCH CENTER (LeRC)
CUYAHOGA COUNTY
CLEVELAND, OHIO

# ENVIRONMENTAL ASSESSMENT
# REHABILITATION OF
# ROCKET ENGINE TEST FACILITY


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The objective of this Environmental Assessment is to review proposed actions associated with the Rehabilitation of the Rocket Engine Test Facility at NASA Lewis Research Center in Cleveland, Ohio. It is our conclusion that the proposed actions will not result in significant impacts to the environment and that an Environmental Impact Statement is not required.

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## LIST OF ACRONYMS

| | |
|---|---|
| BFI | Browning Ferris Industries |
| CEQ | Council on Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| dB | Decibels |
| dBA | Decibels, "A"- weighted (to correspond to human ear response) |
| ft | Feet |
| EA | Environmental Assessment, a document specified by NEPA |
| EIS | Environmental Impact Staterment, a document specified by NEPA |
| EPA | Environmental Protection Agency |
| GPD | Gallons Per Day |
| ha | Hectares |
| HCL | NASA's Hearing Conservation Limit |
| Hertz | Cycle Per Second |
| kHz | Kilo Hertz |
| kPa | KiloPascals, the metric equivalent to PSIA |
| $L_{50}$ | Level not exceeded more than 50% of the time |
| $L_{10}$ | Level not exceeded more than 10% of the time |
| lbs | Pounds |
| LeRC | Lewis Research Center |
| LNF-S-2 | A hazardous waste management unit, as defined in the LeRC Site Investigation |
| m | Meters |

## LIST OF ACRONYMS (CONTINUED)

| | |
|---|---|
| MCL | Maximum Contaminant Level - a contaminant concentration level set to protect water resources |
| N | Newtons |
| NEPA | The National Environmental Protection Act |
| NOx | Nitrogen Oxides |
| PSIA | Pounds per square inch, absolute |
| OEPA | Ohio Environmental Protection Agency |
| PCB | Poly Chlorinated Biphenyl |
| Register | The National Register of Historic Places |
| RETF | Rocket Engine Test Facility |
| ROB | Rocket Operations Building |
| RMS | Root Mean Square |
| SARA | Superfund Amendments and Reauthorization Act |
| SHPO | State Historic Preservation Officer |
| SO2 | Sulfur Dioxide |
| TPH | Total Petroleum Hydrocarbon |
| TSP | Total Suspended Particulate |
| TWA | Time Weighted Average |
| UST | Underground Storage Tank |
| U.S.C | United States Code |
| VOC's | Volatile Organic Compounds |

## I. SUMMARY AND CONCLUSIONS

The following Environmental Assessment (EA) has been prepared in anticipation of a proposed action at the NASA Lewis Research Center (LeRC) in Cleveland, Ohio, to rehabilitate their Rocket Engine Test Facility (RETF) Complex. This proposed action is intended to refurbish and restore an aging and deteriorating rocket engine test facility in order to maintain its historic mission of testing rocket engines. The proposed action and alternatives considered in this EA are listed below:

1. Rehabilitation of the RETF at NASA LeRC in Cleveland, Ohio.
2. No action taken at the RETF at NASA LeRC in Cleveland, Ohio.
3. Duplication of the RETF facilities at an alternate (unspecified) site.

The impacts that these three options would have on eleven environmental parameters have been determined and are summarized in Table S-1. Under the heading of Proposed Action, the question "Are Significant Impacts Possible?" is addressed as either "Not Expected" or "Possible." The answer "Not Expected" implies that our assessment of the available information indicates that there is little likelihood of significant adverse environmental effects associated with the proposed action. The answer "Possible" implies that our assessment indicates some environmental impacts are possible or likely. The final two columns compare the expected environmental impacts of the alternatives against the proposed action. The comparisons indicate either greater, similar or lower environmental impacts are anticipated if the alternatives to the proposed action were selected. A "greater" impact implies the environmental consequences would be more severe than the proposed action, whereas a "lesser" impact implies the environmental consequences would be less severe than the proposed action.

In general, the environmental parameters expected to be most strongly impacted by the proposed action are noise and historical factors, with factors such as water resources and solid and hazardous wastes also being impacted. Noise is a direct consequence of the mission of this facility--which is to test rocket engines and rocket engine components. The historical impacts stem from the fact that Building 202 in the RETF Complex is listed on the National Register of Historic Places. Any modifications to this facility must be made in a manner which preserves the historic architecture/function of the building. Water resources are currently being wasted at the RETF as a result of deteriorating plumbing; the proposed action would correct this problem. As a direct result of this action, the water loadings to the stormwater and wastewater treatment systems are likely to be reduced. Further, these actions would likely improve local water clarity by decreasing siltation and decrease the overall quantity of waters reaching Abram Creek and then the Rocky River.

Neither of the two alternatives considered to the proposed action appear more attractive than the proposed action.

NASA believes an Environmental Impact Statement (EIS) will not be needed since the following mitigation efforts are planned:

1. NASA will maintain the existing acoustic sound barriers in the current design, and will refurbish the muffler/scrubber.

2. NASA will collect additional worker noise exposure data when the facility has been rehabilitated, and will provide such personal protection as is necessary to protect worker hearing.

3. NASA has contacted the Ohio State Historic Preservation Officer (SHPO), provided the SHPO with rehabilitation plans, and has received approval from the SHPO to proceed.

TABLE S-1: SUMMARY OF ENVIRONMENTAL IMPACTS OF ALTERNATIVES

| Environmental Parameters Considered | Proposed Action, are Significant Impacts Possible? | No Action, Impacts Relative to Proposed Action | New Facility Location, Impacts Relative to Proposed Action |
|---|---|---|---|
| Land Resources | Not Expected | Greater | Similar/Greater |
| Air Resources | Not Expected | Greater | Similar/Greater |
| Water Resources | Possible | Greater | Similar |
| Noise | Possible | Similar/Greater | Lower/Similar |
| Biotic Resources | Not Expected | Similar/Greater | Similar |
| Floodplains andWetlands | Not Expected | Similar | Similar |
| Solid Waste | Possible | Lower | Similar/Greater |
| Hazardous Substances and Hazardous Waste Management | Possible | Greater | Similar/Lower |
| Historical, Archeological and Cultural Factors | Possible | Greater | Similar/Greater |
| Social and Economic Factors | Not Expected | Similar | Greater |
| Utilities andTransportation | Not Expected | Greater | Greater |

## II. PURPOSE AND NEED

This EA has been prepared in anticipation of a proposed action at the NASA LeRC in Cleveland, Ohio, to rehabilitate their RETF Complex. Preparation of this EA is consistent with the policies set forth in the NASA Lewis Research Center's Environmental Resources Document (Ref. 1) and the appropriate background documents (Ref. 14-18) regarding analyses to be prepared during the conceptual study phase of any proposed actions at facilities such as the NASA LeRC.

The NASA LeRC is located in the southwest corner of the City of Cleveland (21000 Brookpark Road) and is adjacent to and west of Cleveland Hopkins International Airport. The RETF Complex was built in 1956 (Ref. 20) at a cost of about $2,500,000. The majority of the proposed action is associated with Building 202 at the NASA Lewis site. Building 202 is otherwise known as the RETF; Building 100 is otherwise known as the Rocket Operations Building (ROB) and serves as the existing control center for the RETF. However, the term RETF also is used generically to describe both Building 202 and its

attendant support facilities. Building 202 is located in the relatively remote "South Area" of the Research Center, while Building 100 is located in the southeast corner of the "Central Area" of the Research Center. Building 202 contains about 790 $m^2$ (8,491 $ft^2$) of floor area, of which 531 $m^2$ (5,714 $ft^2$) are usable/occupied. The overall layout of the Research Center is shown in Figure 1.

The existing facility is 36 years old, is out-dated, and in need of repair due to deterioration resulting from testing rocket engines for various space-related applications during this time frame. During the past several years, the RETF has undergone a number of modifications and additions as increasing demands have been placed on the RETF.

Currently, there are three test stands at the RETF, each with its own backlog of test requirements. Characteristics of these three stands are summarized in Table 1.

TABLE 1: DESCRIPTION OF RETF TEST STANDS

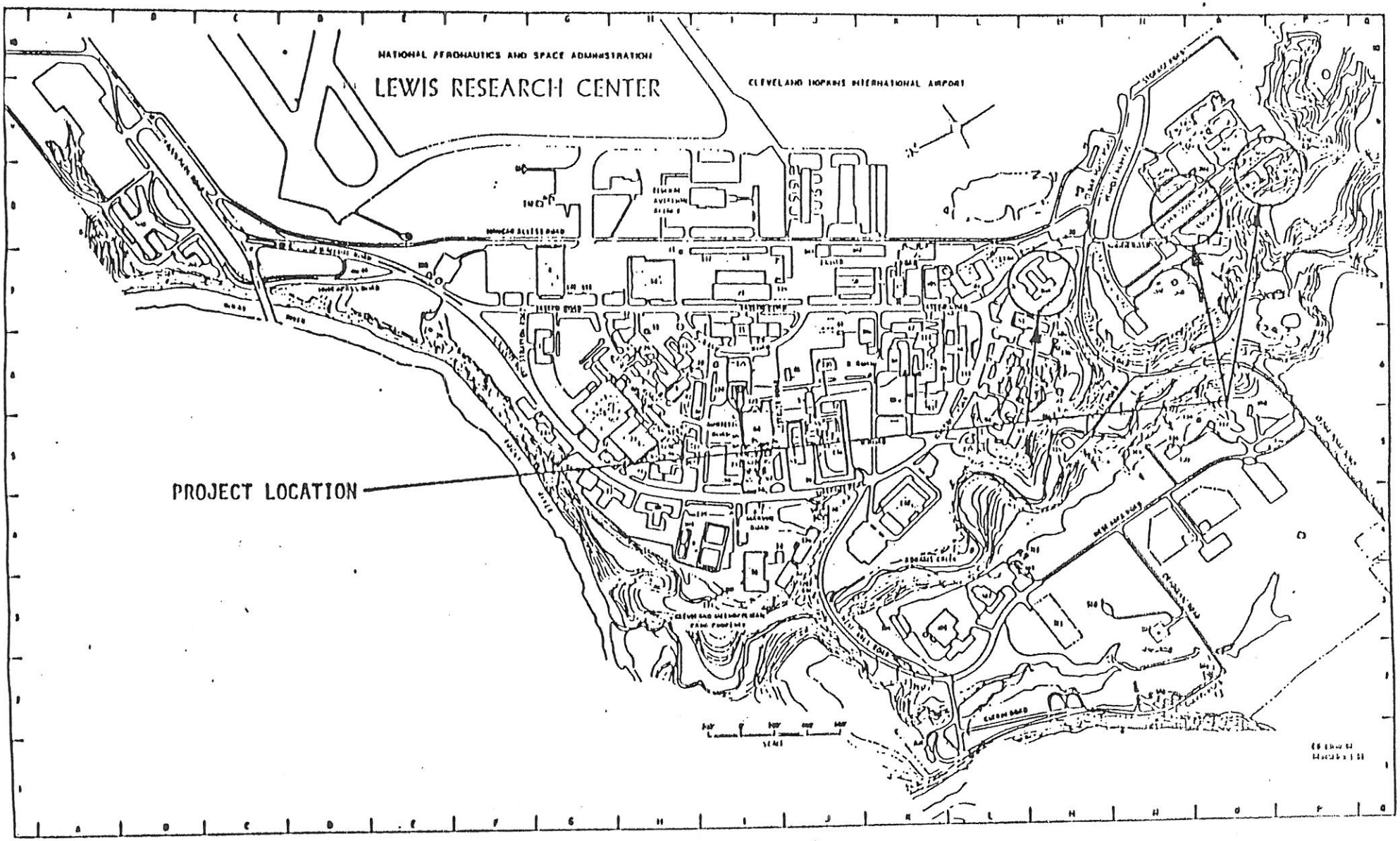
| STAND | CHAMBER PRESSURE kPa(PSIA) | MAXIMUM CHAMBER THRUST NEWTONS (LBS) | TYPES OF TESTS CONDUCTED |
|---|---|---|---|
| A | 29,649 (4,300) | 222,411 (50,000) | Vertical Rocket Engine Sea Level Tests |
| B | 6,895 (1,000) | 6,672 (1,500) | Horizontal Rocket Engine Altitude to 39,650 m (130,000 ft) Tests |
| C | N/A | N/A | Component (e.g., bearings and seals) Tests in Cryogenic Environments (i.e., liquid hydrogen, oxygen and nitrogen; gaseous hydrogen, nitrogen and helium) |

When in operation, the RETF operates about 30 days per year; this would increase up to a total of 60 days per year with the proposed action. On a weekly basis, the facility will operate about three days per week. Engine tests typically begin in the morning and conclude by 7:00 p.m. During a typical day, a 2-3 second firing will be made 50-75 times per day using an 35,586 N (8,000 lbs) thrust engine. In the last year, testing was also conducted on a 71,172 N (16,000 lb) thrust engine, with firings from 3 to 20 seconds, four to five times per day. The proposed upgrades will allow for the testing of 222,411 N (50,000 lb) thrust engines for firing periods up to 20 seconds (Ref. 37).

The major repair needs of the RETF Complex are a result of the deterioration of major hardware items within this facility. For instance, the exhaust muffler/scrubber, which cools and cleans gases emitted from rocket engine tests, has corroded to a level where it is inefficient and does not clean up the off-gases as it did originally, and likely does not control noise to the extent it did when fully operational. Recent examinations of the condition of the muffler/scrubber have shown dramatic deterioration of this system; approximately 50 percent of the capacity is unusable with the deterioration proceeding at an exponential rate. In addition, the cooling water supply system valves and plumbing have deteriorated to the point where tens of thousands of gallons per day (GPD) of water are lost or unaccounted for from this system.

Similar problems exist for the wastewater treatment system. Most of the modifications to these three areas consist of repairing/replacing old hardware with new hardware, cleaning and painting corroded surfaces and updating these systems with modern electronic controls.

REHABILITATION OF ROCKET ENGINE TEST FACILITY




LOCATION PLAN

FIGURE 1

The productivity and integrity of this facility must be maintained and enhanced so the schedule of testing can be maintained. Rehabilitation and modification of the facility under this project will significantly improve productivity through decreased down time for breakdowns and maintenance. Down time due to breakdowns occurs at an ever-increasing frequency as the various facility systems age. Significant improvements in productivity will result from rehabilitation of the muffler/scrubber spray and water systems, the gas storage system, construction of a new control building, improvements in communications systems and various site repairs. This action is intended to maintain the facility in good working order and maintain its capability to test the larger rocket engines for which it was originally constructed.

Specific planned repairs and upgrades are described and summarized below:

1. Repair/rehabilitation of the exhaust muffler/scrubber spray system.
2. Repair/rehabilitation of the exhaust muffler/scrubber water supply system.
3. Repair/rehabilitation of the exhaust muffler/scrubber waste water system.
4. Installation of high pressure and advanced fuels capability.
5. Rehabilitation of existing gas storage and supply systems.
6. Installation of new facility control system.
7. Rehabilitation and modification of the facility intercommunication system and control system wiring.
8. Rehabilitation and modification of facility site and miscellaneous structures.
9. Construction of a new control building.

The proposed action is anticipated to be completed within 24 months.

The proposed action is intended to maintain the capability of the facility to test the larger rocket engines for which it was originally constructed, to increase the capability for remote monitoring and control of tests with modern electronics and to conduct basic rehabilitation activities associated with these buildings and local infrastructure (e.g., parking lots, retaining walls, etc.).

Loss of the muffler/scrubber system would shut down all sea level rocket combustion testing at the RETF until emergency repairs could be made. This loss would critically impact future agency missions. Planned modifications would allow continued operations at the RETF Complex with minimal disruptions.

Detailed explanations of the proposed action associated with this Environmental Assessment can be found in Reference 29. Additional background data can be found in References 2, 3, and 4.

Alternates considered in addition to the proposed action include taking no action and duplication of the RETF Complex at an alternate (unspecified) site.

For all three options, the EA was conducted in accordance with the regulations of the Council of Environmental Quality (CEQ), specifically 40 CFR Part 1500, with governing actions to be taken under the National Environmental Policy Act (NEPA) of 1969, as amended (Public Law 91-190, 42 U.S.C. 4321 et. seq.) (Ref. 5, 6, 15 and 16).

## III. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The proposed action and alternatives consist of the following three choices:

1. Rehabilitation of the RETF Complex at NASA LeRC in Cleveland, Ohio. (Referred to hereafter as "Proposed Action.")
2. No action taken at the RETF Complex at NASA LeRC in Cleveland, Ohio.
3. Duplication of the RETF Complex facilities at an alternate (unspecified) site.

Each of these choices is briefly described below.

### A. REHABILITATION OF THE RETF COMPLEX AT NASA LeRC (PROPOSED ACTION)

The proposed action consists of repairs to the exhaust muffler/scrubber system, cooling water supply system and wastewater treatment system in the RETF Complex. Rehabilitation and upgrades to the systems repaired, and to communication and operations facilities, will also take place under the proposed action. In addition, a new control building (approximately 706 $m^2$, or 7600 $ft^2$) and parking lot will be constructed. This action is necessary to maintain this active test facility in good working order to allow it to perform future missions. This action also will mitigate existing water and wastewater impacts on the environment.

### B. NO ACTION

This alternative assumes none of the proposed activities associated with the proposed action are undertaken. Existing noise, water and wastewater problems are not addressed if this option is exercised.

### C. DUPLICATION OF RETF COMPLEX FACILITIES AT ALTERNATE (UNSPECIFIED) SITE

This alternative assumes that the capabilities of the RETF Complex, as envisioned following the proposed action, would be duplicated at an alternative site. While no specific site has been identified, the analysis assumes that a site would be selected that minimizes many of the impacts of the proposed action at the current location. Such impacts include noise effects due to the urban location of the current RETF Complex and the fact that the current RETF is now registered with the Registry of Historic Places. It is also assumed that alternate site would not differ significantly from the existing site in relation to parameters such as land resources, water resources, biotic resources and floodplains and wetlands. However, selection of this alternative would not eliminate the need to perform basic maintenance on the existing RETF.

## IV. ENVIRONMENTAL IMPACT OF ALTERNATIVES

### A. INTRODUCTION

The organization of this section has been outlined in a format consistent with the NASA Lewis Research Center's Environmental Resources Document (Ref. 1). This format is consistent with, and addressed the factors identified in the Facility Project Implementation Handbook (Ref. 14) and 40 CFR

1216.3 (Ref. 15). Specifically, the impact of the three alternatives described in Section III of this EA are compared and contrasted against the following parameters:

- Land Resources
- Air Resources
- Water Resources
- Noise
- Biotic Resources
- Floodplains and Wetlands
- Solid Waste
- Hazardous Substances and Hazardous Waste Management
- Historical, Archeological and Cultural Factors
- Social and Economic Factors
- Utilities and Transportation.

## B. AFFECTED ENVIRONMENT

For key factors, a set of brief descriptions of the affected environment are presented below. Additional detail can be found in the NASA LeRC Environmental Resources Document (Ref. 1).

### Land Resources

The soil in this area transitions from "Allis Complex" to "Brecksville Silt Loam"; the latter tends to be somewhat unstable.

In terms of land use, the South Area contains about 21.0 ha (51.8 acres) of relatively isolated land, 48.2% of which is classified as open or undeveloped. This land is designated as containing buildings and other structures, open space or land for further expansion. The RETF is located in Parcel C (3.76 ha) (9.29 acres) of the "South Area" as are a majority of the activities associated with the proposed action (Ref. 20). There is a safety zone around the RETF, within the South Area.

### Air Resources

Air quality in the region has generally improved over the past 10 years, although some minor excursions in ozone levels have been seen. These are generally attributed to automobile exhaust. Cuyahoga County, site of the RETF, is currently considered to be a non-attainment area for ozone, $NO_x$, carbon monoxide and total suspended particulate (TSP) and an attainment area for volatile organic carbons (VOC's), and $SO_2$ (Ref. 33).

### Water Resources

Land north of the RETF and adjacent to the Rocky River is part of the Cleveland Metropolitan Park District. This area is increasingly used by the public. Due to the quality of the water in the Rocky River, there may be requirements on the NASA LeRC as a whole to identify options for lowering discharges (due to high fecal counts) to Abram creek and/or the Rocky River. Recent data (Ref. 26) from water (outfall locations #9 and #31) in Abram Creek suggest the greatest concerns are related to Fecal Coliform and Fecal Streptococcus rather than inorganic or organic contaminants. Iron concentrations in a sample from waters at location #9 are also somewhat elevated above Ohio standards.

Water quality data were obtained from the OEPA on the nearby Rocky River, but not for Abram Creek. Data from the Rocky River at river miles 3.0 and 12.1 show Fecal Coliform and Iron levels above the Ohio water quality standards (Ref. 32). Abram Creek receives point discharges from two county wastewater treatment plants (Middleburg Heights and Brook Park sewage treatment plants [STP]) and several small private industrial plants. During low flow periods, wastewater treatment effluent represents the majority of the total flow in the creek (Ref. 38). When silting of the Rocky River occurs, it is generally recognized to be a direct consequence of amount of silt flowing in from Abram Creek (Ref. 36). A complete analysis of the Rocky River basin, including Abram Creek is underway by OEPA, but will not be published until the summer of 1993. However, the proposed action is not expected to increase the fecal or iron levels contained in the waters of Abram Creek.

TABLE 2: COMPARISON OF ABRAM CREEK WATER QUALITY[1] AND MAXIMUM CONTAMINANT LEVEL (MCL) STANDARD FROM OEPA

| CONTAMINANT | MCL[2] | AVERAGE LEVEL UPSTREAM[3] | AVERAGE LEVEL DOWNSTREAM[4] |
|---|---|---|---|
| Fecal Coliform (#/100ml) | 1,000 | 3997.83 | 4814.00 |
| Nitrate (mg/l) | 10 | 2.93 | 1.54 |
| Nitrate | 10 | 0.6 | 0.51 |
| pH (S.U.) | | 7.85 | 7.60 |
| Phosphorous (mg/l) | | 1.06 | 1.64 |
| Phenols (mg/l) | .01 | 8.92 | 9.5 |
| Cadmium (mg/l) | .01 | .0005 | .0005 |
| Chromium (mg/l) | .05 | .03 | .03 |
| Copper (mg/l) | 1 | .01 | .01 |
| Iron (mg/l) | 0.3 | 1.49 | 2.19 |
| Lead (mg/l) | .05 | .001 | .01 |
| Zinc (mg/l) | 5 | .036 | .041 |
| BOD-5 (mg/l) | | 10.58 | 15.70 |
| COD (mg/l) | | 31.23 | 37.70 |

Noise

Noise from the RETF is predominately from the exposed rocket annulus (Ref. 31). Noise from the annulus would be attenuated by the building walls and by the muffler on the exhaust gases. Noise will be absorbed and reflected in the southeast direction by the ravine wall. It is expected that, due to this reflection, the noise vector is greatest to the northeast. Data from firings is very limited for the test area and for the facility boundary.

Sound level data were taken in the terminal control room and test cell within the RETF (Building 202) on September 28, 1992, and November 16-17, 1992, during single rocket tests lasting from 1 to 6 seconds with low thrust (667-890 N) (150-200 lb) engines. Time between tests was 20 to 45 minutes (Ref. 8 and 10). Data

[1] Levels collected as part of the Ohio EPA Rocky River intensive survey, June–August 1981
[2] Ohio Administrative Code 3745-81
[3] Monitoring Station at Eastland Road
[4] Monitoring Station at Cedar Point Road

low thrust (667-890 N) (150-200 lb) engines. Time between tests was 20 to 45 minutes (Ref. 8 and 10). Data taken in 1987 (Ref. 1) indicate a measured exterior noise level of 130 dBA. Personal noise dosimetry results from three workers in the control room during these tests recorded time weighted average (TWA) noise levels of 62.4 to 68.9 dBA over a 3.3-hour time frame. NASA's Hearing Conservation Limit (HCL) for an eight-hour TWA is 80 dBA.

TABLE 3: INSTANTANEOUS SOUND LEVEL MEASUREMENTS

| OPERATION | LOCATION | TIME | INSTANTANEOUS NOISE LEVEL (dBA) |
|---|---|---|---|
| Carbon Dioxide Blowoff (9/28/92) | Test Cell - 4.6 m (15 ft ) away | 14:27 | 133.6 |
| Rocket Ignition - 667 N (150 lb) thrust (9/28/92) | Test Cell - 4.6 m (15 ft ) away | 15:54 | 139.5 |
| Rocket Ignition - 667 N (150 lb) thrust (9/28/92) | Terminal Room By Control Panel | 18:00 | 87.9 |
| Rocket Ignition - 890 N (200 lb) thrust (11/16/92) | Terminal Room By Control Panel | 17:44 | 83.6 |
| Rocket Ignition - 890 N (200 lb) thrust (11/16/92) | Terminal Room By Control Panel | 18:03 | 84.3 |
| Vent High Pressure Water Vapor (11/16/92) | Terminal Room By Control Panel | 18:07 | 73.8 |
| Rocket Ignition - 890 N (200 lb) thrust (11/16/92) | Terminal Room By Control Panel | 19:30 | 84.5 |

Background noise levels from airplanes taking off and landing at the airport have been reported by Steven Parkhurst (Ref. 9) on the south edge of the Sverdrup parking lot. Noise levels recorded from a Delta plane, taken October 1, 1992, at 5:12 p.m. were 95.4 SLM dBA. Maximum noise levels (76 to 82 RMS-dB) were recorded at frequencies of 80 Hz to 1.25 kHz. Other data (Ref. 1) indicated noise levels between 70 and 117 dBA at the Cleveland site for aircraft landing and taking off from Cleveland Hopkins Airport. However, the original source of this data (Ref. 21) has been questioned in recent correspondence (Ref. 22). Another source of historic airport noise data (Ref. 38) also indicates background noise levels from aircraft are significant. Local residential areas are exposed to noise levels of up to 82 $L_{10}$ (dBA) and up to 72 $L_{50}$ (dBA). Aircraft noise levels in the Rocky River Reservation, west of LeRC, are in excess of 85 dBA (Ref. 38).

Community noise impacts are not observed. Current airport noise levels obscure and mask the short term day-time noises from the RETF, and there are no complaints on file from current operations.

Worker noise impacts are currently effectively managed. Using straight-line calculations for noise attenuation, an 85 dBA instantaneous noise level at the edge of the Rocky River Reservation equates to a 125 dBA value outside of the facility. Worker hearing is protected from outside levels as workers are not allowed outside the facility bunkers (within a range of several hundred meters) during tests, for safety reasons.

Noise appears to be attenuated by nearly 50 dBA between the test cell and the terminal room, and tests show worker noised levels to be within OSHA and NASA limits. The tests were run with engines considered "small", and noise is known to be "notably louder during testing of larger engines." NASA has a hearing conservation program. Areas and personnel are routinely evaluated for noise exposure, and personnel in high noise areas are provided routine hearing tests. Where necessary, hearing protection is provided.

Biotic Resources

With the exception of the Upland Sandpiper, no known endangered or protected species are known to be located on/near this site. The Upland Sandpiper has been reportedly (Ref. 11) observed nesting in an area just south of the Cleveland Hopkins Airport. The Ohio Department of Natural Resources (ODNR) was contacted and verified this situation (Ref. 35). No known endangered aquatic species are known to live in the Rocky River (Ref. 11). However, the OEPA (Ref. 34) reports that a crayfish (Orconectes Propinguus), seen in both Abram Creek and the Rocky River, has been classified as "Special Interest." Further, the Big Mouth Shiner (Notropis Dorsalis), seen in both the Rocky River and Baldwin Creek has been classified as "Threatened."

Floodplains and Wetlands

Wetlands do exist near the edges of Abram Creek and the Rocky River, but these locations are not suited for building sites. Building 202 is not directly affected by 100-year floods. A portion of the wastewater treatment system which supports the RETF extends slightly into the 100-year floodplain area.

Historical, Archeological and Cultural Factors

On October 3, 1985, the RETF was listed in the National Register of Historic Places (The Register) (Ref. 27) due to the impact research conducted in this facility has had on manned space flight. The RETF Complex includes two major buildings (RETF - Bldg. 202 and ROB - Bldg. 100) as well as a number of support facilities. While somewhat confusing, only the RETF, or Building 202, appears to have been designated for inclusion in the Register based on maps and documentation contained in the application to the U.S. Department of the Interior. Consequently, any changes to Building 202 proposed as part of this alternative must follow the Standards for Rehabilitation (36 CFR 67) and the Guidelines published by the U.S. Department of the Interior National Park Service (Ref. 13).

Social and Economic Factors

While approximately 4,500 employees work at the NASA LeRC, only a small fraction of these are assigned to the RETF Complex. Over half of the NASA LeRC employees are in professional disciplines such as engineering and the sciences. Permanent employees outnumber contract employees by a factor of 2:1. NASA Lewis is the 26th largest employer in the Cleveland Consolidated Metropolitan Statistical Area (CMSA).

## C. ENVIRONMENTAL IMPACTS

A summary of the environmental impacts of each of the alternatives on these parameters is outlined below.

Land Resources

Land Resources generally describes the physical features of the land, including a specific description of the soils, local geology and local seismology. It also includes a review of land use, management and planning associated with the proposed alternatives.

Rehabilitation of RETF Complex at NASA LeRC

In general, the proposed action is not expected to have a net negative impact on this environmental parameter. Significant site work, including excavations, trenching, soil contouring and construction of retaining walls will impact the land in this area. However, the proposed action is expected to have a positive impact by stabilizing the local soils and managing rainwater runoff (Ref. 1 and 20). These changes should also have a net positive impact on Abram Creek, located adjacent to the RETF.

The proposed action will not affect prime or unique farmland, and is consistent with current land use. Rehabilitation will not require new land: the construction of a new control building and parking lot will utilize about 1000 $m^2$ (10,000 $ft^2$) of NASA-owned land that lies within the South Area and within the safety zone. This land is grassed, and serves as part of the safety buffer.

No Action

If the proposed action is not implemented, the deteriorating conditions currently existing at the site will not be mitigated and will have a negative impact on local soil stability and Abram Creek.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

By definition, land used at a new site will likely be affected more negatively than land already dedicated to the existing facility under the proposed action. Selection of an alternate site will, by definition, require additional land resources; the proposed site uses land already dedicated to the testing of rocket engines. New land use requirements would be site dependent. The current complex uses about 20 acres (7 ha).

Air Resources

Air Resources consists of a review of the climactic conditions (i.e., general weather patterns, wind direction and weather hazards) and a review of air quality conditions (i.e., regulations, ambient air quality levels and emission sources) associated with the proposed alternatives.

Rehabilitation of RETF Complex at NASA LeRC

Climatic conditions are not expected to have any significant impact on the proposed action. Impacts on air quality conditions were considered under two time scenarios: 1) during construction activities, and 2) during subsequent operations. During construction, impacts will include minor impacts on air quality due to sandblasting, painting, paving and grading/excavation/trenching (i.e., generation of dust) actions associated with the proposed action.

Improvements to air quality are expected following completion of the proposed action. Although the RETF Complex was given a "clean bill of health" in a 1988 report by Knox Consultants (Ref. 7), the facility has generally degraded since that time. The proposed action should reverse this trend. For instance, replacement of leaking pipes, valves, etc. associated with this action, will have a secondary effect in lowering energy needed for such boilers and consequently emissions released to the air.

Testing of larger engines will cause the release of increased volumes of water vapor and carbon dioxide to the air over current levels. During rocket test firings, the RETF has the capacity to burn many fuels. However, current plans limit fuel sources to hydrogen and kerosene. The product of combustion of hydrogen and oxygen is predominately water and the products of combustion of kerosene and oxygen are primarily water and carbon dioxide. Kerosene is similar to the jet fuel used by commercial airlines. Air

emissions from the RETF facility are expected to be small (<1/1000) of that of nearby aircraft leaving Hopkins airport, based on a empirical ratio of aircraft operations to test operations.

While the proposed action will possibly affect air quality in the short term, the overall impacts are expected to be minimal.

No Action

Under this scenario, there would be no impact associated with the construction that would occur under the proposed action. However, the trend of increasing deterioration of the RETF Complex would continue under this alternative, which would be expected to increasingly impact air quality.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Duplicating this facility at another site would have greater consequences than the proposed action due mainly to the magnitude of the impacts associated with construction of an entirely new facility. Following the construction period, the impacts would be expected to be similar to the proposed action.

Water Resources

This category is generally concerned with the impact of the proposed alternatives on the quality of the affected surface and groundwater along with any impacts related to past/future spills into these waters.

Rehabilitation of RETF Complex at NASA LeRC

Like the previous section on air resources, the impact of the proposed action on water resources is expected to be greatest during construction. Erosion of local soils and the subsequent impacts of surface water runoff to Abram Creek (and then to the Rocky River) may result in some short-term impacts.

The proposed action is intended to correct problems with surface water runoff and water leakage from the muffler/scrubber water supply and wastewater systems. As discussed under the "No Action" alternative, this action is expected to have a net positive impact on water resource utilization and protection.

Although groundwater quality data are not available, the proposed action is not expected to negatively impact groundwater quality.

No Action

In this scenario, there would be no construction-related impacts as in the proposed action. However, the trend of increasing deterioration of the RETF Complex would continue under this alternative. This would be expected to increasingly impact water quality. As noted in Reference 2, "Valves in the (water) supply lines are so badly worn that tens of thousands of gallons of water are lost each day through leakage." No action would result in continued/increasing amounts of lost or unaccounted water. The consequences of this situation are wasted water, possible increases in soil instability and increased loadings (e.g., water, soil runoff) to Abram Creek. In addition, the lack of improvements to the wastewater and stormwater systems will have similar negative impacts.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Duplication of this facility at an alternate site would be expected to have similar impacts to that of the proposed action in that use of water resources would be expected to be well managed at a new site.

Noise

This part of the assessment consists of a review of existing noise conditions and their impacts on workers and the local community as well as the noise impacts associated with the proposed alternatives. Given the nature of the RETF Complex (i.e., testing rocket engines), this category is expected to have some of the greatest impacts associated with the proposed action and has received considerable attention through a series of recent noise measurement studies (Ref. 9-11).

Rehabilitation of RETF Complex at NASA LeRC

The overall impacts of the proposed action have been divided into two categories: 1) community noise impacts and, 2) worker noise impacts.

Since noise levels for future rocket tests are unknown, the impacts future testing will have on noise levels at the perimeter of the site (community noise levels) as a result of this action are also unknown. However, assuming night/extended tests are banned, and that RETF facility noise is an infrequent occurrence (up to 300 seconds per day), community noise levels are unlikely to be impacted by the proposed action due to the high levels of background noise generated by nearby Cleveland Hopkins International Airport. In addition, any noise impact is likely to be attenuated by the fact that noise from the facility is naturally isolated by its location in the ravine (topographical location) containing Abram Creek. For these same reasons, the impact of this alternative on the nearby nesting sites of the Upland Sandpiper, a protected species seen in the area, are also likely to be minimal.

While the noise levels generated during future tests of rocket engines are unknown, the proposed action will likely increase the current noise levels experienced by workers. Currently, Tests show that current worker exposures are within allowable limits set by OSHA as well as by NASA. After rehabilitation, NASA will again test noise levels at the RETF. Specific mitigation activities are available if noise levels are too high, and include: 1) ensuring workers in the terminal control room wear appropriate hearing protection equipment; 2) installing soundproofing materials in the terminal control room; and/or 3) removing workers from the RETF during test firings.

Construction activity associated with the proposed action will also increase noise in the short term. However, construction noise is apparently normal at the site according to the Environmental Resources Document (Ref. 1).

No Action

If no action is taken, and the muffler/scrubber portion of the RETF continues to degrade, one can expect the noise levels to steadily increase. The impacts associated with this alternative are likely to be similar or greater than that of the proposed action.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Assuming a new facility was designed explicitly to minimize noise impacts (e.g., more remote location), such impacts would be less than those of the proposed action. If such considerations were not part of the design package, then the impacts would be expected to be similar.

Biotic Resources

In this assessment, Biotic Resources generally refer to the impacts the alternatives will have on wildlife and plant resources and endangered and protected species.

Rehabilitation of RETF Complex at NASA LeRC

The proposed action is expected to have minimal impact on biotic resources. Data indicate that species diversification in the local Rocky River Reservation have increased over the past few years; this alternative is not expected to change this trend. Direct impacts on water resources which might affect these waterways have been addressed earlier.

No Action

The consequences of no action are expected to be similar or greater to those identified in the analogous section on water resources. Further deterioration of the RETF Complex and its supporting facilities will likely maintain/increase the stormwater runoff to the local waterways. While there do not appear to be many biotic resources affected by the RETF Complex, those that do exist will be increasingly adversely affected if this alternative is exercised.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Assuming a site were selected, and a facility built, that minimized the impact on biotic resources, this alternative would be expected to have similar impacts to the proposed action on this resource.

Floodplains and Wetlands

This category is generally concerned with the impact of the proposed alternatives on facilities within the 100-year floodplain and on wetlands. Wetlands are generally defined as those areas having high water tables which are poorly drained and support vegetation acclimated to water.

Rehabilitation of RETF Complex at NASA LeRC

None of the activities associated with the proposed action are expected to directly affect wetlands. Further, none of the planned activities propose building in wetland areas. Silt runoff, etc., associated with construction activities could have secondary effects on these wetland areas, but the effects should be minimal.

Furthermore, some of the proposed site work (e.g., installation of a culvert near Building 202) are intended to mitigate the consequences of a potential 100-year flood on nearby retaining walls/embankments.

No Action

As with the proposed action, the only major effect of this option are secondary impacts to wetlands associated with stormwater runoff and loss of water from deteriorating piping. Uncorrected, these problems probably pose a slightly higher risk to wetlands around Abram Creek; regardless, the impacts are expected to be minimal.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

It has been assumed that an alternate site would be selected that has little or no impact on floodplains or wetlands. In this case, the impacts would be similar between this alternative and the proposed action.

Solid Waste

This category generally considers the generation of solid wastes associated with the alternatives considered. Solid wastes are distinct from both hazardous wastes (described in the next section) and special wastes such as flyash from coal power plant burners. Solid wastes are regulated at the federal level by the Resource Conservation and Recovery Act (RCRA), Subtitle D and by State Solid Waste Codes. In Ohio, the licenses to dispose of solid wastes are handled by the OEPA and monitored by the local County Health Departments. In general, solid wastes are hauled to local landfills or incinerated as final disposal options. Currently, BFI handles the Research Center's solid wastes (Ref. 1). BFI transports the wastes to the Oberlin Landfill in Lorain County for final disposal. None of the wastes produced at the NASA LeRC are currently disposed of on site.

Rehabilitation of RETF Complex at NASA LeRC

In the process of upgrading, modifying and rehabilitating the RETF Complex and its associated facilities, considerable amounts of solid waste are likely to be produced from demolition, construction and escalation activities. This will include construction wastes such as old plumbing (e.g., piping, valves, tanks) from the muffler/scrubber, water and wastewater systems, metal and wood removed during retaining wall restoration efforts, and wastes resulting from construction of a new Controls Building. Additional solid waste can be expected from the rehabilitation of support facilities outlined in the Preliminary Engineering Report and subsequent amendments (Ref. 29, 2, 3 and 4). In addition, considerable solid waste will result from packing materials associated with items installed into the facility as part of the rehabilitation efforts. Excavation activities have been estimated to generate over 765 $m^3$ (1,000) of soil which will be trucked to a sanitary landfill as regulated solid waste due to the presence of non-RCRA hazardous chemicals (e.g., Total Petroleum Hydrocarbons [TPH]) under NASA/LeRC policy and EPA rules (Ref. 31 and 39). Wastes from cleaning/rehabilitation operations will be classified as solid wastes or hazardous wastes depending on the nature of the materials used during cleaning and/or sandblasting operations.

Some evidence exists (Ref. 23 and 28) that an old solid waste landfill (LNF-S-2) existed several hundred feet north of the RETF. However, none of the proposed activities, including construction of a new RETF control room, will likely impact this old solid waste disposal site.

No Action

Under this alternative, none of the solid wastes associated with the proposed action will be generated.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Construction of a new facility at an alternate site would be expected to generate at least as much solid waste as that generated under the proposed action. Solid wastes from excavation, construction waste, packaging materials, etc. for a new facility would likely exceed those from the upgrading activities planned under the proposed action.

Hazardous Substances and Hazardous Waste Management

This category generally considers the generation and management of hazardous wastes associated with the alternatives available. A series of federal regulations identify which solid wastes should be considered hazardous (i.e., Resource Conservation and Recovery Act), require notification of the public/employees of the presence/toxicity of hazardous waste (i.e, Material Safety Data Sheets, require inventories of hazardous materials be documented and maintained (SARA Title III) and define how to handle and clean up spills/releases of hazardous wastes (CERCLA). In many cases, analogous state laws also regulate hazardous wastes. Applicable federal and state regulations for hazardous wastes are described in detail in the Environmental Resources Document (Ref. 1, Table 9-1). Specific regulations exist for the disposal of PCB's, Pesticides, Underground Storage Tanks (UST's), asbestos and radioactive wastes. Hazardous wastes generated at the NASA LeRC are currently collected every 30 to 60 days from satellite locations and stored in Building 212 prior to final disposal off-site.

Rehabilitation of RETF Complex at NASA LeRC

No specific data are available regarding expected amounts of hazardous wastes to be generated as a result of implementation of this alternative. However, based on a review of available information, no PCB's, mercury (soils) or lead (paint) are known to be present in the areas impacted by the proposed action (Ref. 31). In addition, no underground storage tanks (UST's) are known to exist at the site (Ref. 19 and 24).

Bionetics has recently completed a local (Building 202 area) site soil survey in the areas where construction is planned (Ref. 25). Eight borings were taken at four proposed excavation sites. The borings were taken down to a level one foot below the expected excavation level. Sample locations included the parking lot area, the Dewar area, the vaporizer area and the area for expansion of the shop. The Dewar and vaporizer samples were combined prior to analysis. Only the soils under the area planned for expansion of the shop (containing trace amounts of chlorinated hydrocarbons) were recommended for disposal to a hazardous waste facility (Ref. 31 and 39). The other two site samples contained trace amounts of petroleum hydrocarbons and coal ash chemicals. Soils from these locations were recommended for disposal in a sanitary landfill. No PCB or mercury contamination was found in these samples.

A cursory examination of the RETF did not reveal the presence of asbestos in this facility. However, Ohio statute requires a formal survey of proposed demolition/renovation areas be completed and the findings of such a survey be reported to the OEPA. This survey is anticipated to be done as part of the formal permitting process.

Hazardous materials generated while operating this facility are not expected to change in amounts or types as a result of this action. Any hazardous wastes generated while operating the RETF would be transported to Building 212 for final disposal consistent with current policies (Ref. 12).

No Action

Selection of this alternative would be expected to result in similar/greater impacts than the proposed action. This is based on the presumption that any hazardous material on site are currently on site. Thus, with a deteriorating facility and the addition of time, one would not expect the situation to improve. Further, if any hazardous materials are present, the uncontrolled releases of water described earlier will only enhance the transport of the such materials into the groundwater and local surface waters.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

Assuming one would select a site not contaminated by hazardous materials for construction of a new RETF Complex, the impacts would be similar or less than those of the proposed action. If the current RETF site does not contain hazardous materials, the impacts would be similar; if it does, the impacts would be less.

Historical, Archeological and Cultural Factors:

The intent of reviewing any proposed action against these three parameters is to ensure that historical, archeological and cultural items are not lost to future generations.

Rehabilitation of RETF Complex at NASA LeRC

Of the three parameters in this area, historical factors appear to be much more important than archeological or cultural factors. There have been no known or reported archaeological artifacts found on the site to date.

Because Building 202 is such a unique building (in that it is, and continues to be, a working research facility) so as to be included in the National Register, the following discussion has been added for background purposes.

The U.S. Department of Interior's Standard for Rehabilitating Historic Buildings (Ref. 13) states that:

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
2. The historic character of a property shall be retained and preserved. The removal of historic materials or alterations of features and spaces that characterize a property shall be avoided.
3. Each property shall be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
4. Most properties change over time, those changes that have acquired historic significance in their own right shall be retained and preserved.
5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.
6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
7. Chemical or physical treatments, such as sandblasting, that cause damage to historic material shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.
8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.
9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterized the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

According to the Standard, modifications to a historic building should take place in the following order: Protect and Maintain, Repair and finally Replace.

In this particular situation, there is a conflict between the first standard (i.e., to keep the RETF performing in its historic role)--which requires the updates, rehabilitation and repairs proposed to maintain a safe and capable facility--and the balance of the standards which seek to maintain the historic architecture/character of a building.

Proposed changes to Building 202 are listed below. Potential justifications for moving forward with these activities are provided within the parentheses following each item:

- Repair/Replace retaining walls at the RETF. (In order to protect the building's foundations, this appears to be allowed under the Standard's section on Building Site recommendations.)

- Repair/Replace outdoor platforms and stairways which have rusted away. (This action appears to be recommended under the repairing/replacing recommendations listed in the Architectural Metals and Health and Safety sections of the Standard. It is strongly recommended the replacement materials match the original architecture.)

- Replace the existing muffler/scrubber spray valve enclosure with a new, larger enclosure. (Again, under the Architectural Metals section this appears to be allowed. However, changing the size of the enclosure would not normally be encouraged. One might argue that the provision requiring the facility to maintain its historic role would give one latitude in increasing the size [i.e., capability] of this enclosure. Again, architectural similarity should be maintained.)

- Replace detention tank pump house roofing, flashing and gutters. (Within the repairing/replacing recommendations in the Roofing section of the Standard it would appear this action is acceptable so long as architectural similarity is maintained.)

- Repair and repaint the exterior concrete walls and foundation which have badly spalled in some areas. (Item #7 in the Standard specifically prohibits sandblasting of historic structures. However, the Building Exterior section concerns itself mainly with the effects of such action on masonry brick and stone. Provided the cleaning action is designed to restore the walls to their original condition for the purpose of continuing to use the facility in its historic role, this action may be acceptable. However, less aggressive cleaning techniques should be considered and used if feasible).

- Rehabilitate and repair detention tank spray system. This will consist of cleaning, repairing and repainting various basin surfaces, replacing valves and pumps and heat tracing key plumbing. (This area may not be formally part of the Building 202 historical submission. However, if it is, cleaning techniques described in the previous bullet should be used).

- Update and expand shop area an additional 117 $m^2$ (1,260 $ft^2$). Maintain existing architecture. (This is probably the most contentious issue in this area. Altering the exterior perimeter of a historic building should be done only after all other options to use interior or other external space have been exhausted. Provided this is the case, the additions [See New Additions to Historic Buildings Section] should minimize the impact on the original architectural design of the building.)

- Replace metal halide lighting with sodium lighting in the test cell area. Increase outdoor lighting near the test cell area. (The Standard, under the Interior Features and Finishes section, strongly discourages the replacement of light fixtures. If additional light is needed for safety reasons, these changes could be made under the Health and Safety provisions of the Standard.)

- Repair and repaint muffler/scrubber shell; replace internal muffler/scrubber components. (If the internal components of this system cannot be repaired, replacement of these parts with similar components is acceptable under the Mechanical Systems section of the Standard. The shell of the muffler/scrubber should be cleaned in a manner which minimizes further damage to the shell.)

From the preceding text, it is clear that even though the preceding modifications can probably be made within the context of the Rehabilitation Standard, there will be an impact on the historical value of this building. Efforts to minimize these impacts do appear to have been made based on information contained in the recent draft of the Preliminary Engineering Report (Ref. 29). NASA has contacted the State Historic Preservation Officer (SHPO) to ensure historic impacts are minimized. In response, the SHPO stated that they had reviewed the plans and concluded that the plans would have no effect on the integrity of the structure which is listed in the National Register (Ref. 31).

No Action

Since major portions of Building 202 have already deteriorated, and the process continues to accelerate, this alternative would be expected to have greater negative impacts on the facility. Further, this option is inconsistent with the primary goal of the Rehabilitation Standard which is to preserve historic buildings.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

There are no known historical impacts associated with a new RETF Complex. However, the Rehabilitation Standard implies that the owners of a historic building will seek to preserve that building. Thus, costs would still be incurred to preserve the old RETF under this alternative. In addition, the archeological and cultural impacts associated with a new site would not be expected to be better than the current site. Consequently, the overall impacts of this alternative were rated similar to greater than the proposed action.

Social and Economic Factors

This category addresses the impacts of the alternatives on available workforce and sociological features in the local area such a population, employment levels and the impact the alternatives would have on local economics.

Rehabilitation of RETF Complex at NASA LeRC

The overall impacts of the proposed action on social and economic factors is expected to be minimal. The largest impact is likely to be the addition of construction workers to the site, but this impact on the overall community is also likely to be relatively small (Ref. 1 and 20).

Because the number of workers affected by the action is expected to be relatively small in the context of an urban setting, the impacts on local economics, employment levels, schools, medical facilities and parks is also expected to be minimal.

No Action

The overall impacts associated with this alternative are expected to be similar to that of the proposed action because it will have a relatively minor impact on a large metropolitan urban area such as Cleveland.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

In this case, the impacts are expected to be greater than the proposed action. This stems from two primary causes. First, in order to overcome some of the noise, proximity to urban population and other problems outlined earlier in this assessment, the new facility is likely to be sited in a more remote location. In this case, the local economics, schools, medical facilities, etc. are likely see greater impacts than with the proposed action. In addition, a more remote site would tend to be selected to obtain land area at a reasonable price. Finally, the magnitude of the construction activities and the costs of duplicating the RETF would be expected to be much greater than those for simply updating an existing facility.

Utilities and Transportation:

Under this category, the impact of the alternatives on local infrastructure is reviewed. Specifically provided are answers to questions such as how the utilities (such a gas, electricity, water and sewer) will be impacted by the alternatives. In addition, how will local transportation systems such as roads, airports and public transportation be impacted by the alternatives?

Rehabilitation of RETF Complex at NASA LeRC

Due to the urban location, along with the well established network of utilities (water, sewer, gas and electricity) and roads, airports and public transportation (Ref. 1 and 20), the impacts of the proposed action are expected to be minimal.

No Action

The impacts of no action are expected to be greater than that of the proposed action. This stems from the consequences of deteriorating water, surface water and wastewater treatment systems. Under this scenario, tens of thousands of gallons of water per day will continue to be wasted. This will exacerbate the surface water runoff and wastewater treatment problems which are also addressed under the proposed action.

Duplication of RETF Complex Facilities at Alternate (Unspecified) Site

The impacts of this alternative are also expected to be greater than that of the proposed action due to the assumption that the alternate site will be somewhat more remote than the current site. Consequently, it is likely that the utility and transportation infrastructure of this new site would need to be upgraded/established to accommodate a facility such as the RETF Complex.

## V. LIST OF AGENCIES AND INDIVIDUALS CONSULTED

The following organizations and individuals contributed information contained in this environmental assessment:

| ORGANIZATION | INDIVIDUAL | TYPES OF INFORMATION PROVIDED |
|---|---|---|
| Lawhon and Associates, Inc.<br>6330 Proprietors Road<br>Worthington, OH 43085<br>614-436-8400 | Mr. Paul Braun<br>Dr. William Lawhon<br>Mr. Frank Lowery<br>Mr. Stephen Petty<br>Mr. Russell Smith | Land resources; air resources; water resources; noise; biotic resources; floodplains and wetlands; solid waste; hazardous waste; historical, archeological and cultural factors; social and economic factors and utilities and transportation. |
| NASA Lewis Research Center<br>21000 Brookpark Road<br>Cleveland, OH | Mr. Daryl Edwards<br>Mr. Don Urasek | Land resources; solid waste; hazardous waste; historical, archeological and cultural factors; noise and utilities and transportation. |
| The Bionetics Corporation<br>1100 Apollo Drive<br>Brook Park, OH 44142 | Mr. Theodore Thomas | Water Resources; solid waste; hazardous waste; historical factors and noise. |
| The Ohio EPA<br>Cleveland, OH<br>(216) 963-1177 | Mr. David Stroud | Water Resources (Environmental Specialist -Div. of Water Quality, Planning and Assessment) |
| The Ohio EPA<br>1685 Westbelt Dr.<br>Columbus, OH 43228<br>(614) 777-6264 | Mr. Chuck McKnight<br>Mr. Charles Boucher | Endangered Species (Fish and "Bugs"). Both are Environmental Scientists. |
| Cleveland Bureau of Air Pollution Control<br>City of Cleveland<br>Cleveland, OH<br>(216) 664-2188 | Mr. Craig Berssan | Air Pollution (Mr. Berssan is an Environmental Engineer for the City of Cleveland). |
| Ohio Department of Natural Resources (ODNR)<br>Columbus, OH<br>(614) 265-6472 | Ms. Debby Woischke | Endangered Species (Plants and animals - Heritage Data Base). |
| Cleveland Metro Parks Administration<br>Cleveland, OH<br>(216) 351-6300 | Mr. Tom Stanley | Biotic Resources and Water Resources |

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