OHIO HISTORY

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office

OHIO HISTORIC PRESERVATION OFFICE
RESOURCE PROTECTION AND REVIEW

Section 106 Review Project Summary Form

For projects requiring a license from the Federal Communications Commission, please use FCC Forms 620 or 621. <u>DO NOT USE THIS FORM.</u>

<u>SECTION 1: GENERAL PROJECT INFORMATION</u>

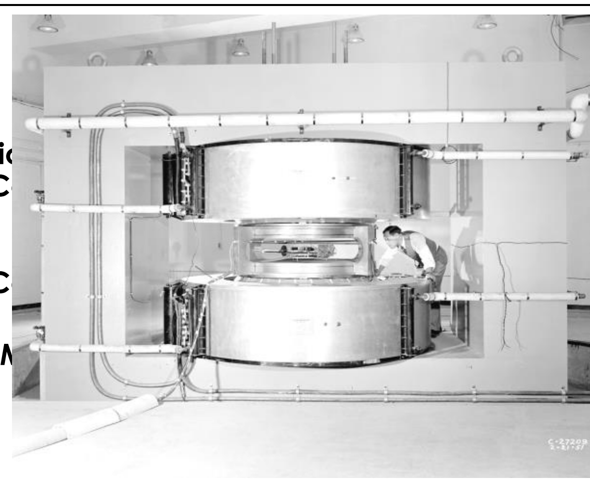
All contact information provided must include the name, address and phone number of the person listed. Email addresses should also be included, if available. Please refer to the instruction or contact an OHPO review (mail to: Section 106@ohiohistory.org) if you need help completing this Form. Unless otherwise requested, we will contact the person submitting this Form with questions or comments about this project.

Date: **March 2016**

Name/Affiliation of person submitting form:
Leslie A. Main
Historic Preservation Offic
NASA Glenn Research C

Mailing Address:
NASA Glenn Research C
Facilities Division
21000 Brookpark Road, M
Brook Park, OH 44135

Phone/Fax/Email: **(216) 433-6345**



A. Project Info:

1. This Form provides information about:
   New Project Submittal:
   YES ☒ **NO** ☐

   Additional information relating to previously submitted project:
   YES ☐ **NO** ☒

2. Project Name:
   Demolition of Materials and Structures Auxiliary Building 140, The Cyclotron

3. Internal tracking or reference number used by Federal Agency, consultant, and/or applicant to identify this project (if applicable):
   13957

B. Project Address or vicinity:
   NASA Glenn Research Center at Lewis Field
   21000 BrookPark Road
   Brook Park, OH 44135
   (216) 433-6345

C. City/Township:
   Brook Park, Ohio

D. County:
   Cuyahoga

E. Federal Agency and Agency Contact. *If you do not know the federal agency involved in your project, please contact the party asking you to apply for Section 106 Review, not OHPO, for this information*. *HUD Entitlement Communities acting under delegated environmental review authority should list their own contact information.*
   National Aeronautics and Space Administration (NASA)
   Leslie A. Main
   Historic Preservation Officer
   NASA Glenn Research Center
   Facilities Division
   21000 Brookpark Road, Mail Stop 21-1
   Brook Park, OH 44135
   (216) 433-6345

F. Type of Federal Assistance. *List all known federal sources of federal funding, approvals, and permits to avoid repeated reviews.*
   NASA Construction of Facilities (CoF) Funds

G. State Agency and Contact Person (if applicable):
   (NA)

H. Type of State Assistance:
   None

I. Is this project being submitted at the direction of a state agency **solely** under Ohio Revised Code 149.53 or at the direction of a State Agency? *Answering yes to this question means that you are sure that no federal funding, permits or approvals will be used for any part of your project, and that you are seeking comments only under ORC 149.53.*
   YES ☐ **NO** ☒

J. Public Involvement- Describe how the public has been/will be informed about this project and its potential to affect historic properties. Please summarize how they will have an opportunity to provide comments about any effects to historic properties. (This step is required for all projects under 36 CFR § 800.2):
   Demolition of the project will be posted in:
   - **Cleveland Plain Dealer**
   - **Sun Newspapers**
   - **West Life Weekly Newspaper**

K. Please list other consulting parties that you have contacted/will contact about this project, such as Indian Tribes, Certified Local Governments, local officials, property owners, or preservation groups. (See 36 CFR § 800.2 for more information about involving other consulting parties). Please summarize how they will have an opportunity to provide comments:

- **NASA newsletter, Aerospace Frontier**
- **NASA Retirees**

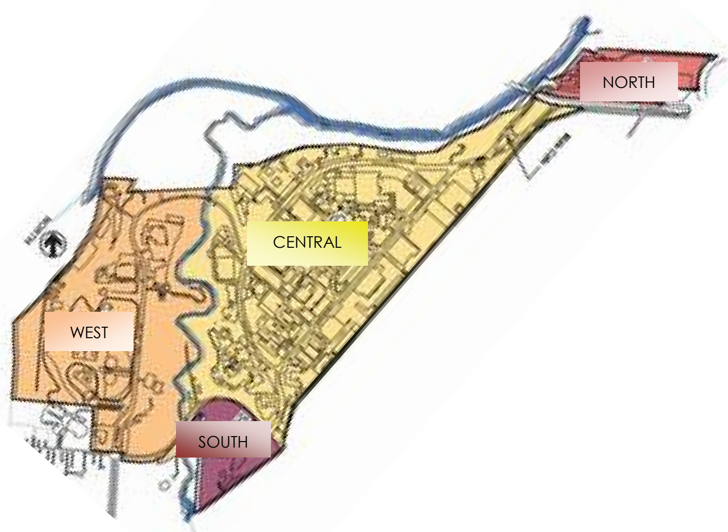
SECTION 2: PROJECT DESCRIPTION AND AREA OF POTENTIAL EFFECTS (APE)

Provide a description of your project, its site, and geographical information. You will also describe your project's Area of Potential Effects (APE). Please refer to the Instructions or contact an OHPO reviewer if you need help with developing the APE or completing this form.

For challenging projects, provide as much information as possible in all sections, and then check the box in Section 5.A. to ask OHPO to offer preliminary comments or make recommendations about how to proceed with your project consultation. This is recommended if your project involves effects to significant historic properties or if there may be challenging procedural issues related to your project. Please note that providing information to complete all Sections will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

NASA Glenn Research Center is situated adjacent to the western boundary of the Cleveland Hopkins International Airport in Cleveland, Ohio and Cuyahoga County. The Metropolitan Park District borders Glenn on the West and North sides. The City of Fairview Park, Ohio borders Glenn on the North also and The City of Brook Park, Ohio borders Glenn on the South side. The center is divided into four general areas; Central, South, West and North and comprises 350 acres of land. It contains more than 150 buildings and over 500 specialized research and test facilities. After the Air, races the site was transformed into a World-Class research laboratory and quickly made contributions to the war efforts.

Bldg. 140, The Cyclotron, is an underground complex located adjacent to Bldg. 49, Materials and Structures Laboratory on the south. It is tucked in the southwest corner of the central section of the campus. The underground facility extends below grade approximately 18'-0" and above grade approximately 11'-0" with an additional 3'-0" of earth covering creating a mound. Grass seed was planted over the mound so it would blend in with the other lawns on campus.



The Cyclotron Facility was designed, manufactured, constructed and installed by General Electric from 1949 to 1955. The Cyclotron was a 60" frequency that

produced 21-mega-electron-volt deuterons and 42 mega-electron volt alpha particles. The structure was built completely out of concrete: floors, wall and ceilings, all 1'-0" thick or more.

In 1955, General Electric turned the facility over to National Advisory Council on Aeronautics (NACA) for operation. It operated extensively until 1970. An underground access tunnel and a buried cable trench were built to connect the facility to the basement of Building 49. Building 49 housed a control room and an electrical equipment room for the Cyclotron. The Cyclotron Facility comprised of a Neutron Therapy Room (NTR), sometimes called the Vault, a storage room, a vault entrance, shield room, sump pump pit and a workroom. Small structures and a penthouse were placed above grade on top of the mound. In the late 50's a treatment room addition was constructed. In the late 70's a control room, an above ground mechanical equipment room with a driveway for vehicular access and an exit stairway for a second means of egress were all added to the facility.

The Cyclotron performed a variety of irradiation experiments. The activities included radiation damage studies, general nuclear physics research, and some production of radioisotopes by bombardment of targets. The research was done in support efforts by NACA, later NASA, to study basic nuclear phenomenon and later to study the effects of radiation on materials in support of aircraft nuclear propulsion. As the nation began exploration of high altitude flight and ultimately space research, the studies and research were to advance knowledge of the behavior of materials when exposed to ionizing radiation. The Cyclotron would accelerate charged particles into a narrow beam and bombard small test samples of aircraft materials (typically aluminum and other aircraft grade materials) to determine how the strength and other physical properties were affected by long-term exposure to radioactive particles.

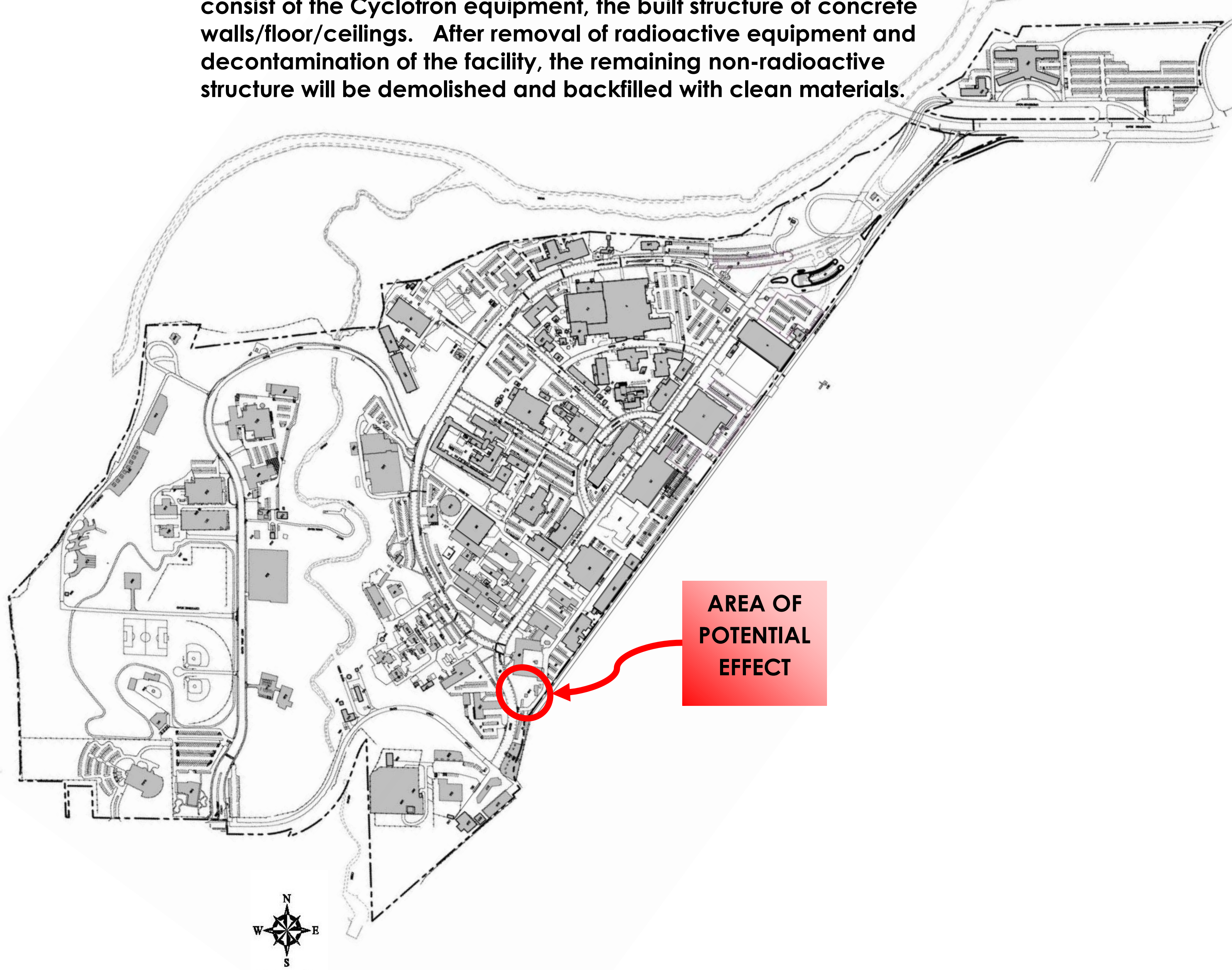
The Cyclotron was also used to study the strength of materials that had been subject to radioactive particles. These tests would simulate the long-term exposure of metals and other materials that aircraft would experience during long duration and high altitude flights. Experience operating and performing experiments with the Cyclotron helped GRC staff gain experience to design and operate the Plum Brook Station Reactor, now decommissioned and demolished.

Dismantlement of the *original* cyclotron equipment was performed from October of 1970 until July of 1971. *This was* in preparation for the installation of a larger Cyclotron. The installation of 69-inch cyclotron was *completed* in 1972 when startup testing began. The 69-inch cyclotron had capability to accelerate all light ions to variable energies. NASA's records show that nuclear related research at the cyclotron was terminated in 1972; a few months after the upgraded cyclotron became operational. The *use of nuclear propulsion for* aircraft was deem impractical due to safety and economic concerns. However, the early promise of nuclear propulsion it nurtured basic research in materials. In 1975, a cooperative program between NASA and the Cleveland Clinic Foundation was implemented in which the Cyclotron would be operated by

NASA technicians to provide neutron radiation therapy to oncology patients under the care of Cleveland Clinic Foundation medical staff. Building remodeling was done to provide for a patient receiving area. Additional particle beam control systems were installed to allow generation of collimated neutron beams in a patient treatment center. The experimental treatment program lasted until late 1990 when the program was terminated after treating about 1200 patients.

The Cyclotron was closed and facility repairs were completed that were intended to provide a degree of environmental protection for the Cyclotron and the facility while radiation levels decayed to manageable levels to allow contaminated material and equipment to be removed efficiently and safely.

NASA Glenn Research Center is currently working on the final stages of planning the dismantling of the Cyclotron and sending the radioactive components to a Nuclear Regulatory Commission (NRC) approved waste site. The components consist of the Cyclotron equipment, the built structure of concrete walls/floor/ceilings. After removal of radioactive equipment and decontamination of the facility, the remaining non-radioactive structure will be demolished and backfilled with clean materials.



JURISDICTION TRANSFER MAP
NASA Glenn Research Center at Lewis Field

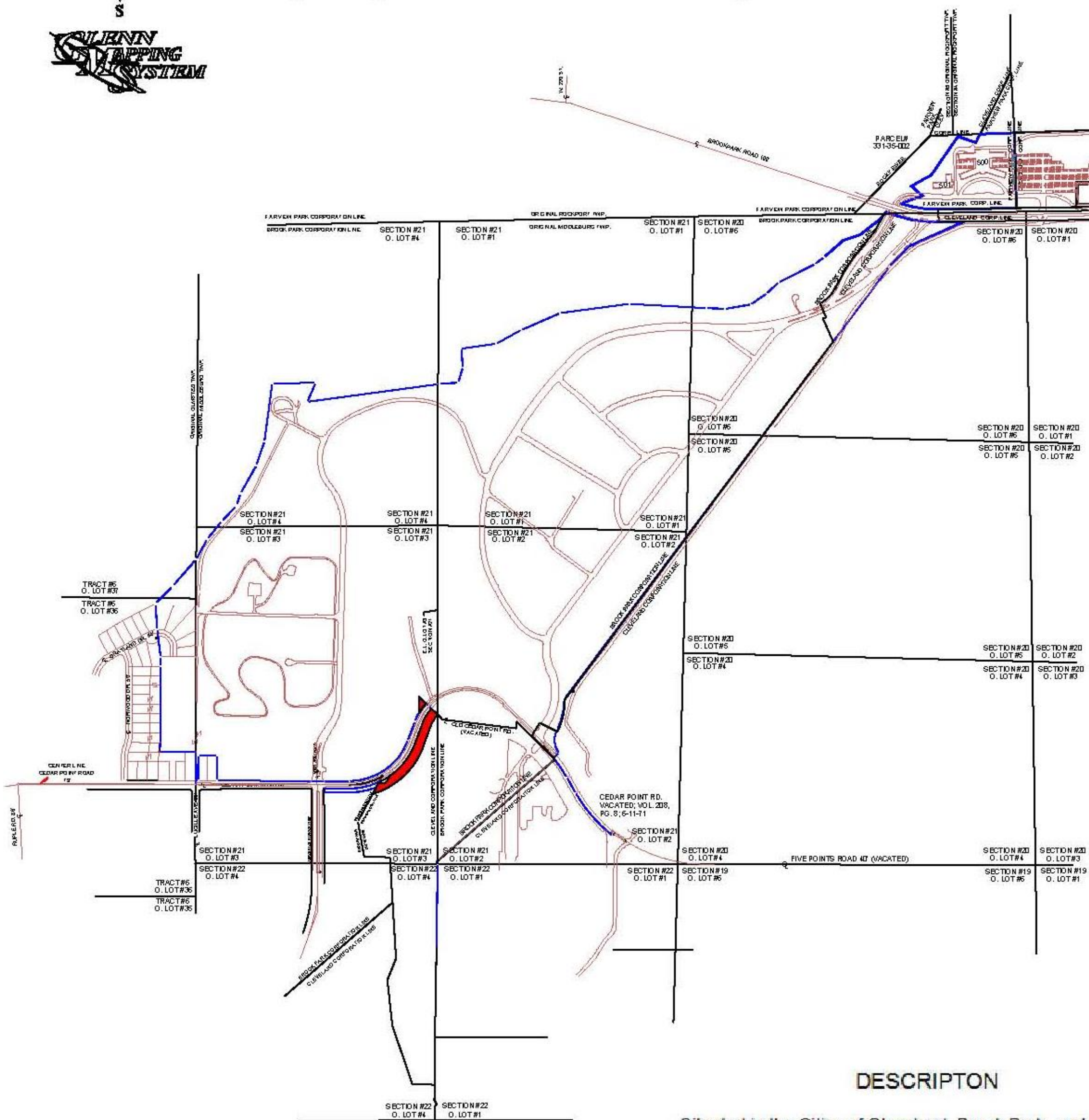


Exhibit A

NOTICE/DISCLAIMER

Exhibit A, Jurisdictional Transfer Map is a representation of the best available estimate of the scope of the property known as NASA Glenn Research Center, Cleveland, Ohio.

Exhibit A is not an instrument of conveyance governed by the standards of Ohio Administrative Code Sections 4733-37 through 4733-37.07; but is a notification of record of the transfer of legal jurisdiciton pursuant to Ohio Revised Code 159.04(B) of the NASA Glenn Research Center at Lewis Field from the United States of America to the State of Ohio via an executed Deed of Cession.

April 8, 2011

DESCRIPTON

Situated in the Cities of Cleveland, Brook Park, and Fairview Park, County of Cuyahoga, State of Ohio, containing 2 Parcels of land herein described:

PARCEL 1

Being part of Original Middleburgh Township Section Nos. 20, 21, and 22 and generally described as bounded by Cleveland Hopkins International Airport to the east, a line about 660 feet south of the north line of Section 22 to the South, Cuyahoga Metropolitan Park to the West, and Brookpark Road to the north, being bounded and described in the metes and bounds beginning at a point 30.00 feet North 0° 03' 51" East of the intersection of the centerlineof Cedar Point Road (width varies) with the Centerline of Lucille Avenue (60 feet wide) and containing 342.2 acres of land more or less.

PARCEL 2

Being part of Original Rockport Township Section Nos. 4 and 5, generally bounded by Brookpark Road to the South and the Cuyahoga Metropolitan Park to the west, being bounded and described in the metes and bounds beginning at a point in the northerly line of Brookpark Road (100 feet wide) N 0° 55' 50" West, 50.00 feet, from a monument Box near the entrance to Parcel 1 and containing18.9 acres of land more or less.

GRC
GLENN RESEARCH CENTER
at Lewis Field

A. Does this project involve any Ground-Disturbing activity: **Yes** ☒ **No** ☐
(If **Yes**, you must complete all of Section 2.A. If **No**, proceed directly to Section 2. B.)

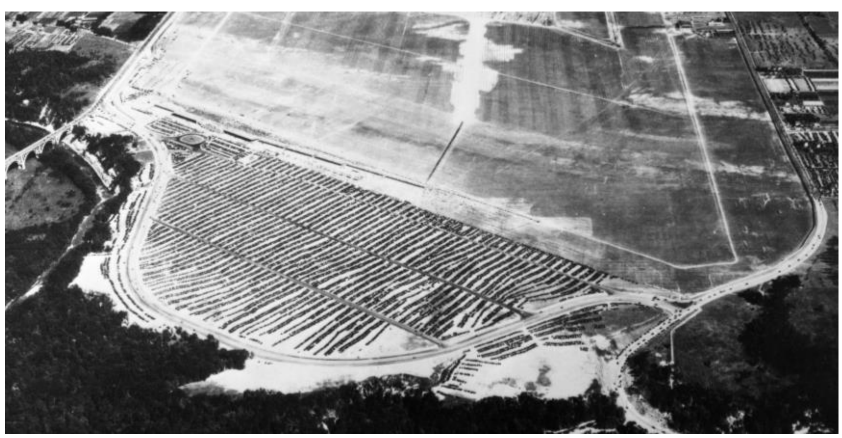
1. General description of width, length and depth of proposed ground disturbing activity:
Demolition of the Cyclotron will cover approximately 6,000 SF, 18'-0" deep and removal of the earthen mound. The volume area covers all the utilities that have to be removed, the foundations and the Cyclotron.

2. Narrative description of previous land use and past ground disturbances, if known:
The only past ground disturbance GRC has knowledge of is the disturbance when NACA constructed a new research laboratory, the Aircraft Engineering Research Laboratory (AERL). The design of the new lab required ground disturbance for installing underground utilities as well as placing building foundations in the ground. All of the 350 acres of GRC have been disturb at one point in time or more.

Air Races

In 1920, the idea of an Air Show first came to America from Europe when Joseph Pulitzer, publisher of the *New York World*, put up the money for a race on Long Island's Mitchell Field. Pulitzer's goal was to re-awaken interest in aviation, which was suffering from post WWI apathy. The event circulated to different cities for nine years and was finally brought to Cleveland in 1929 by a group of local businessmen headed by Louis W. Greve and Frederick C. Crawford.
The 1929 Cleveland National Air Races had full civic support not only from the city manager W. R. Hopkins but also from the Cleveland Chamber of Commerce.

The event was a 10-day sensation setting the highest standard for Air Shows with amazing demonstrations, size, duration and attendance.
The city built permanent grandstands and there were hangers available for visiting aircraft. The airport was so large that the Air Races could take place without interfering in normal airport operations.



Parking Lot of Air Races and future site of NASA GRC

In 1929, airplanes were still considered something of a science fiction fantasy. There were closed-course pylon races and cross-country races from as far away as Log Angeles, Miami and Toronto, all timed to reach Cleveland on different days of the show. Women pilots, including the already famous Amelia Earhart, raced in a special "Powder Puff Derby" from Santa

Monica, California, to Cleveland. It was the closed-course racing that provided the most thrills for the fans in the stands.

In 1934, the Depression had cut the purses and the show had shrunk to a Labor Day weekend festival, similar to today's Air Show. The Air Races continued to be successful despite the Depression; therefore, the National Aeronautical Association gave Cleveland a five-year option on the event.
As the war took shape in Europe, it became difficult for the pilots to gain financial support necessary for the increasingly sophisticated planes. In addition, the military was withdrawing its support from the Air Show industry and there were no new airplane designs. As America geared up its war machines, the races were discontinued. After the war the Aircraft Industrial Association, an aircraft manufactures trade group, brought back the races to Cleveland to showcase the advances made during the war. Cleveland once again obtained a five-year franchise for the event. The Defense Department budget cuts halted military participation in future shows. After 20 years of thrills and spills, the National Air Races closed its doors.

Government Should Do Research

Glenn was founded in 1941 by the National Advisory Committee for Aeronautics (NACA), the precursor to NASA, and was initially called the Aircraft Engine Research Laboratory (AERL). In 1958, NACA changed to NASA. After several more name changes, in 1999 it received its current name, NASA John H. Glenn Research Center at Lewis Field, Glenn Research Center (GRC) for short. The center was named in honor of former senator and astronaut, John H. Glenn. He was an Ohioan who was the first American to orbit earth when he piloted "Friendship 7" around the globe three times in 1962. Lewis Field is named after NACA first executive director, George W. Lewis.

NACA started a wartime research program with focus on applied sciences in aeronautics. Lewis began to build respect with the military and the aircraft industry. NACA went before the US House of Representatives for Appropriations to gain support for an additional research facility. He stressed that Langley was limited and that private industry did not conduct the necessary research. He also pointed out that the government does not compete with the private sector. Lewis continued to make a case for a new research facility.

Early model of NACA

He wanted the new facility to have an altitude wind tunnel and mentioned that one did not exist anywhere in the world. He also stated that there was very little scientific engine research being done in the United States and that the government was the best choice to do the research. The government would be impartial and it would tackle problems for the entire industry and that the

information would be equally accessible to all companies. Congress approved the establishment of a new NACA Aircraft Engine Research Laboratory.

NACA chooses Cleveland for new lab location

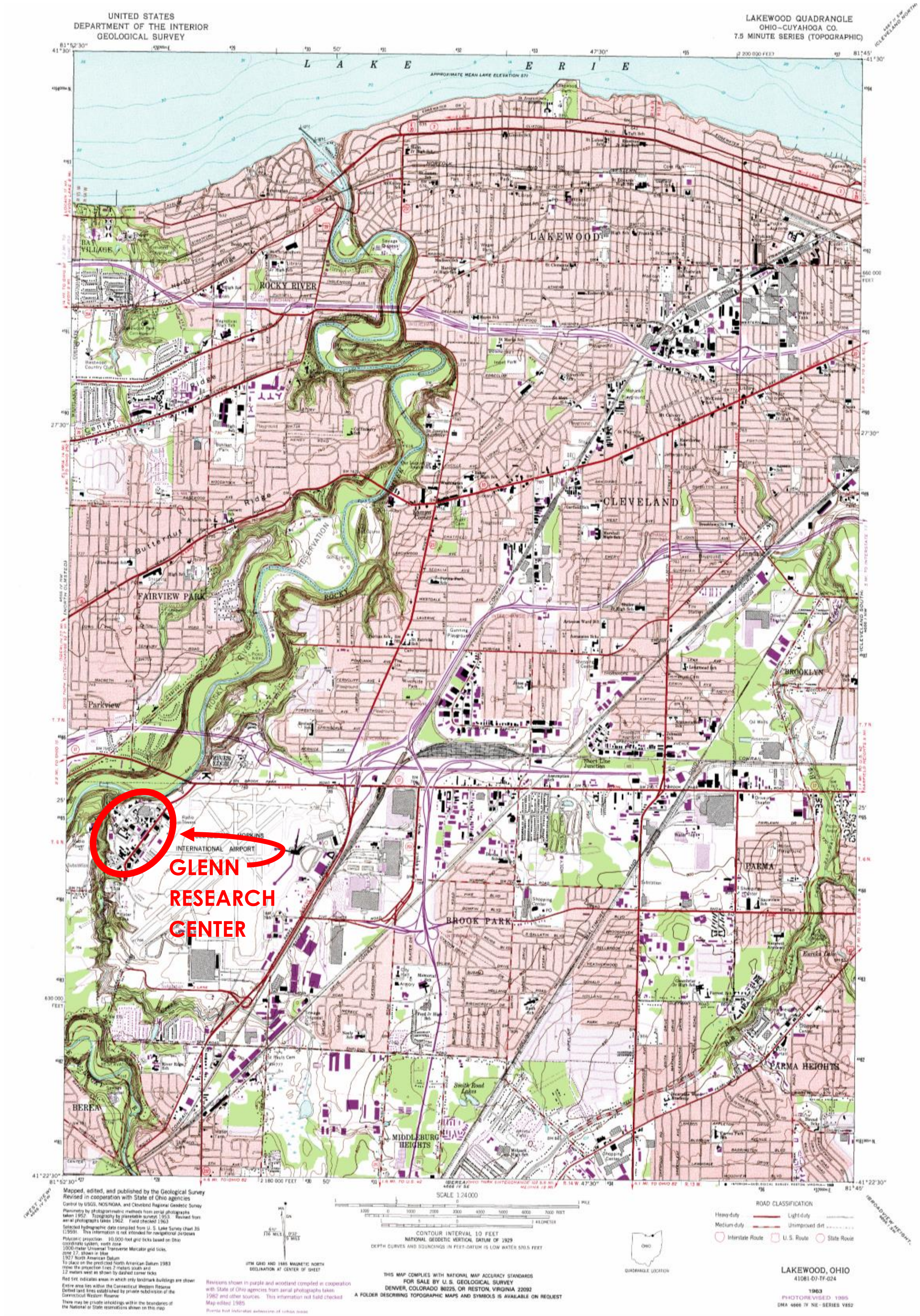
There were many good qualities about Cleveland that were brought to the attention of NACA. To win the bid and have the new research facility located in Cleveland, Ohio, Cleveland Chamber of Commerce moved into high gear. The Chamber brought to light that Cleveland was located in the nation's industrial heart. It had at least 80-90 companies all catering to aviation in the Cleveland area. Cleveland was the connection between Pennsylvania coal fields and the iron in Minnesota. It had open hearth mills in the flats along the Cuyahoga River, highway connections, was serviced by six major railroads and a dependable and plentiful electric company. Cleveland also had two excellent educational institutions called Case School of Applied Science and Western Reserve University. The schools have now merged into one and renamed Case Western Reserve University. It had its own water system and it was located on the Great Lakes that industrial companies used to transport product cheaply.

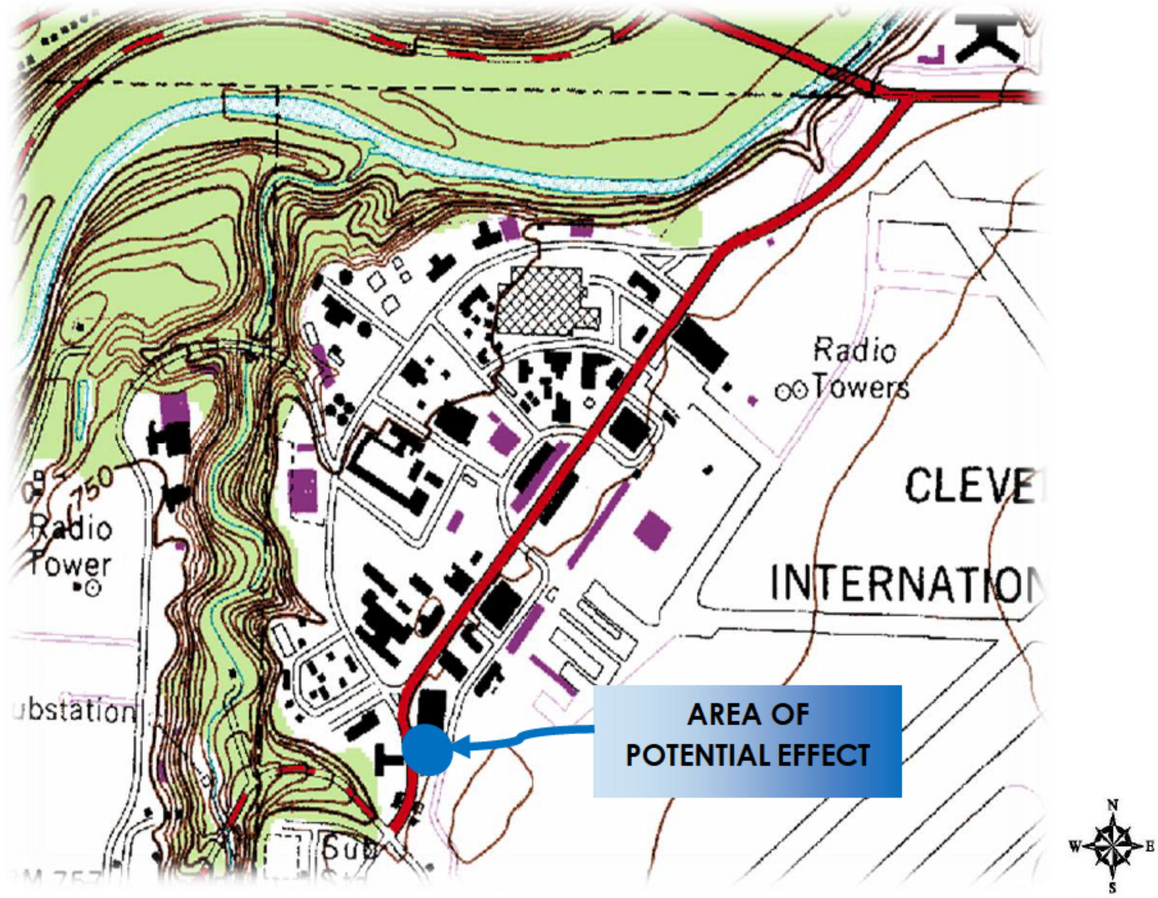
With help from Crawford in negotiations, and the City of Cleveland making 200 acres of land available next to the Airport for $1.00/acre, and the electric company negotiating a lower rate, NACA selected Cleveland as its next new lab location.

3. Narrative description of current land use and conditions:
   GRC is currently an active research and development laboratory owned by NASA, a federal government agency. The Cyclotron Facility is currently unoccupied an in poor condition. GRC is completing documentation for the final decommissioning steps and preparing for demolition of the remaining structure. The site is contained by a wire fence to prevent unauthorized entry into the exclusion zone.

4. Does the landowner know of any archaeological resources found on the property?
   Excessive excavation was done to construct the Cyclotron originally and no archaeological resources were found at that time, therefore, there are no known archaeological resources located at the site of Bldg. 140 Materials and Structures Auxiliary Building. Refer to Archaeological Sensitivity Map on page 17.

D. Submit the exact project site location on a USGS 7.5-minute topographic quadrangle map for all projects. Map sections, photocopies of map sections, and online versions of USGS maps are acceptable as long as the location is clearly marked. Show the project's Area of Potential Effects (APE). It should be clearly distinguished from other features shown on the map:





Enlarged USGS 7.5-minute topographic quadrangle map

1. USGS Quad Map Name:
   Lakewood, Ohio

2. Township/City/Village Name:
   Brookpark, Ohio

C. Provide a street-level map indicating the location of the project site; road names must be identified and legible. Your map must show the exact location of the boundaries for the project site. Show the project's Area of Potential Effects (APE). It should be clearly distinguished from other features shown on the map:

D. Provide a verbal description of the APE, including a discussion of how the APE will include areas with the potential for direct and indirect effects from the project. Explain the steps taken to identify the project's APE, and your justification for the specific boundaries chosen:
The APE is bounded by Building 49 to the North, Walcott Road on the West, Cleveland Hopkins International Airport on the East, and J Road on the South. The Cyclotron facility covers approximately 6,000 SF above and below grade. The volume area includes all the utilities that have to be removed, the foundations of the Cyclotron, the cable trench, the corridor to Building. 49 and the Cyclotron. Although Building 140 is accessed through the basement level of Building 49, Building 49 will not be affected by this demolition. Refer to for boundary diagram on page 22.

E. Provide a detailed description of the project. This is a critical part of your submission. Your description should be prepared for a cold reader who may not be an expert in this type of project. The information provided must help support your analysis of effects to historic properties, not other types of project impacts. Do not simply include copies of environmental documents or other types of specialized project reports. If there are multiple project alternatives, you should include information about all alternatives that are still under active consideration:
The Cyclotron has been decommissioned and left in place to allow for the natural reduction of radioactive contamination. After the removal of all low level radioactive materials from Building 140 and clearance of the site by the Nuclear Regulatory Commission (NRC), the remainder of the facility will be demolished. All contaminated materials will be properly contained and shipped to a NRC licensed disposal facility. The demolition of Building 140 will include the removal of all utilities and demolition of all structures and foundations. The hole will be backfilled with clean materials, and the site will be graded to match the surrounding conditions. The site will be seeded for grass and used as green space after the demolition is complete.
Adaptive use of building 140 is not achievable. If the Cyclotron were reused for new radiation testing, its design has an archaic function not suited for modern research. NRC will clear the site that all radioactive materials are removed and disposed of properly, but the building will always be perceived as still having some level of radioactivity in it and not being completely environmentally free from harm. Demolition is the best and safest solution because it will remove all doubt.

SECTION 3: IDENTIFICATION OF HISTORIC PROPERTIES

Describe whether there are historic properties located within your project APE. To make that determination, use information generated from your own Background Research and Field Survey. Then choose one of the following options to report your findings. Please refer to the Instructions and/or contact an OHPO reviewer if you are unsure about how to identify historic properties for your project.

If you read the Instructions and you're still confused as to which reporting option best fits your project, or you are not sure if your project needs a survey, you may choose to skip this section, but provide as much supporting documentation as possible in all other Sections, then check the box in Section 5.A. to request preliminary comments from OHPO. After reviewing the information provided, OHPO will then offer comments as to which reporting option is best suited to document historic properties for your project. Please note that providing information to complete this Section will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

Recording the Results of Background Research and Field Survey:

A. Summary of discussions and/or consultation with OHPO about this project that demonstrates how the Agency Official and OHPO have agreed that no Field Survey was necessary for this project (typically due to extreme ground disturbance or other special circumstances). Please **attach copies** of emails/correspondence that document this agreement. You must explain how the project's potential to affect both archaeological and historic resources were considered.
There were no discussions with OHPO regarding the Cyclotron to date, however, a letter from OHPO about the determination of the Plum Brook Station Reactor can be found in Appendix C.

B. A table that includes the minimum information listed in the OHPO Section 106 Documentation Table (which is generally equivalent to the information found on an inventory form). This information must be printed and mailed with the Project Summary Form. To provide sufficient information to complete this Section, you must also include summary observations from your field survey, background research and eligibility determinations for each property that was evaluated in the project APE.
Documentation Table can be found in Appendix A

C. OHI (Ohio Historic Inventory) or OAI (Ohio Archaeological Inventory) forms- New or updated inventory forms may be prepared using the OHI pdf form with data population capabilities, the Internet IForm, or typed on archival quality inventory forms. To provide sufficient information to complete this Section, you must include summary observations from your field survey and background research. You must also include eligibility determinations for each property that was evaluated in the project APE
2014 Ohio Historic Inventory (OHI) for Building 140, Materials and Structures Auxiliary Building can be found in Appendix B

D. A historic or archaeological survey report prepared by a qualified consultant that meets professional standards. The survey report should meet the Secretary of the Interior's Standards and Guidelines for Identification and OHPO Archaeological Guidelines. You may also include new inventory forms with your survey, or update previous inventory forms. To complete this section, your survey report must include summary observations from your field survey, background research and eligibility determinations for each property that was evaluated within the APE.

Excessive excavation was done to construct the Cyclotron originally and no archaeological resources were found at that time, therefore, there are no known archaeological resources located at the site of Bldg. 140 Materials and Structures Auxiliary Building. Refer to Archaeological Sensitivity Map on page 17

E. Project Findings. Based on the conclusions you reached in completing Section 3, please choose one finding for your project. There are (mark one):

- ☐ **Historic Properties Present in the APE:**
- ☑ **No Historic Properties Present in the APE:**

Based on the four criteria for acceptance to the National Register of Historic Places, Bldg 140, Materials and Structures Auxiliary Building does not meet one of the four criterions:
A - Events, Patterns in History
B - Significant Individuals
C - Architecture, Engineering, Design
D - Potential to Yield Information

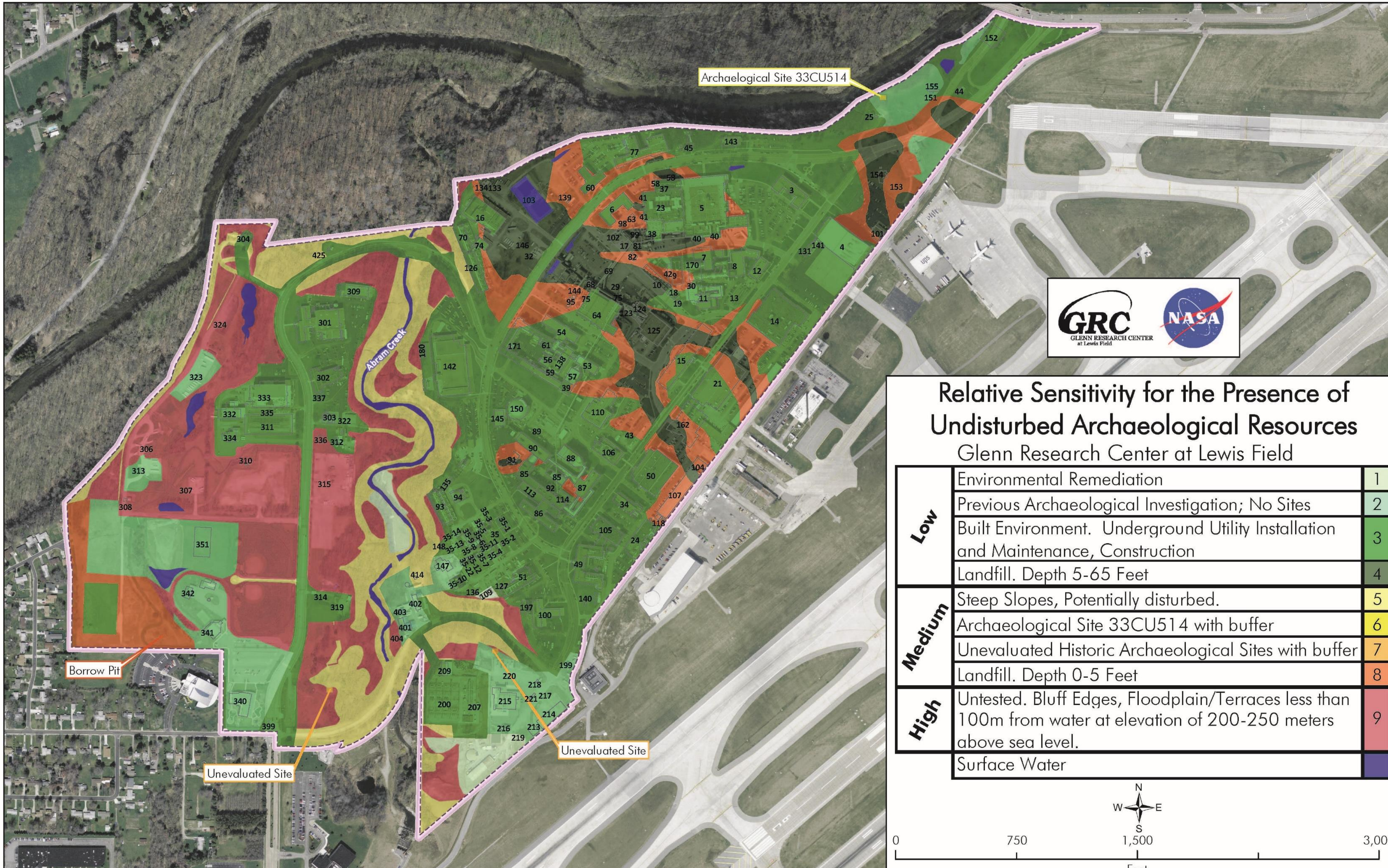
The Cyclotron is an underground facility rising partially above grade covered with an earthen mound. The facility has never been associated with other historic buildings or structures, therefore Criterion C does not apply.

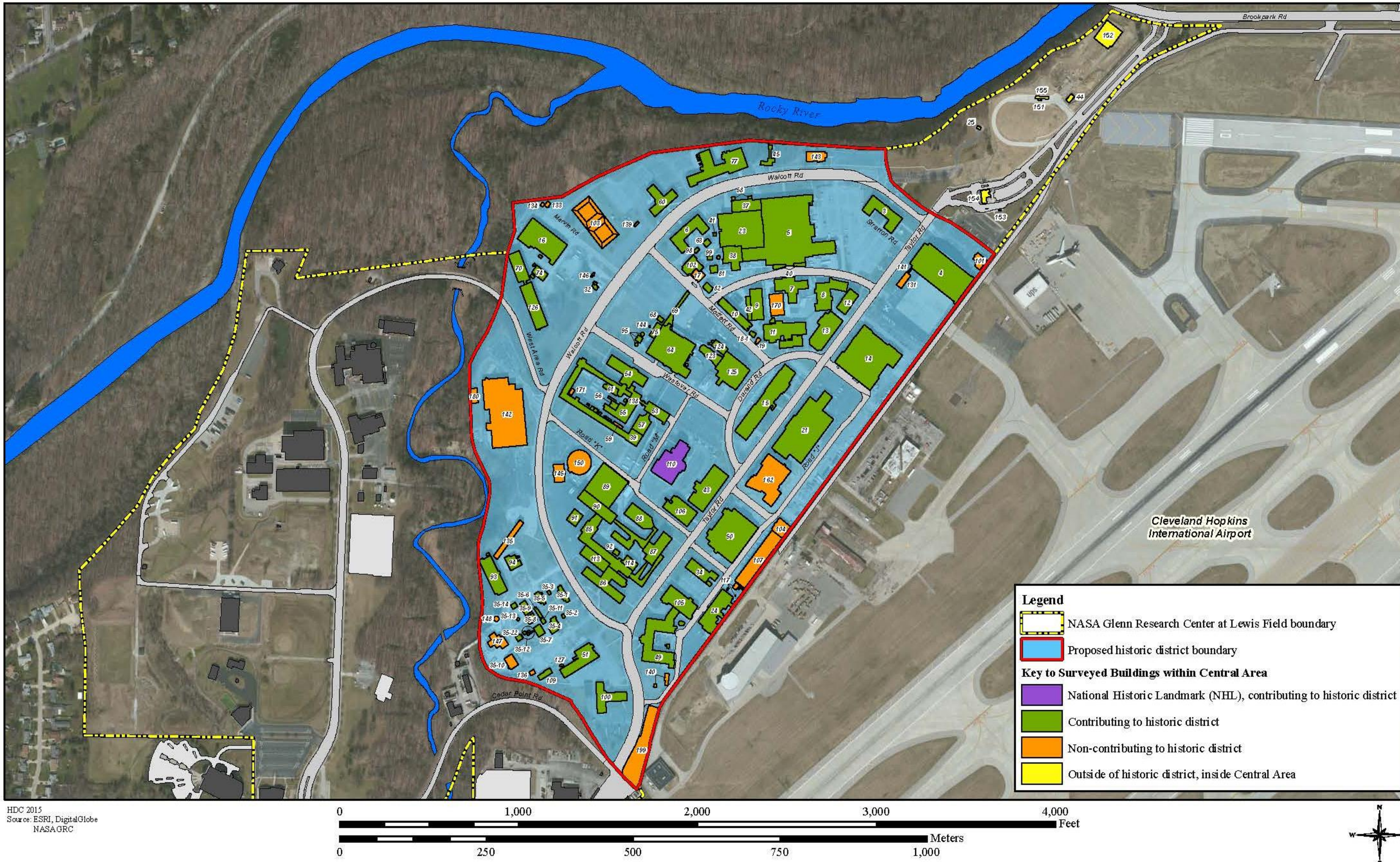
The materials and research that was originated for the use of the Cyclotron was cancelled during the conceptual stage so no significant research was completed at this facility; therefore, Criterion A does not apply.

From the first groundbreaking shovel of soil that launched construction of the AERL in the early 40's and installation of underground utilities to current new construction of today, no archaeological finding were ever located, therefore, Criterian D does not apply.

NASA GRC does not consider the Cyclotron Facility a historic property because no groundbreaking research was performed within Building 140,has no other historic significance and does not individually meet the criteria for eligibility for listing on the National Register for Historic Places (NHRP).

GRC has a Historic District that is eligible for listing on the National Register for Historic Places. The Cyclotron is located within the boundary of the historic district as a non-contributing structure. Refer to the Historic District Map on page 18. Also, refer to the <u>Historic Resources Survey Report for NASA Glenn Research Center, Lewis Field Brook Park, Cuyahoga County, Ohio by Ross Barney Architects and Hardlines Design Company (2015)</u> delivered to your office at the Historic District Meeting December 14, 2015.


Relative Sensitivity for the Presence of Undisturbed Archaeological Resources
Glenn Research Center at Lewis Field
Low
Environmental Remediation 1
Previous Archaeological Investigation; No Sites 2
Built Environment. Underground Utility Installation and Maintenance, Construction 3
Landfill. Depth 5-65 Feet 4
Medium
Steep Slopes, Potentially disturbed. 5
Archaeological Site 33CU514 with buffer 6
Unevaluated Historic Archaeological Sites with buffer 7
Landfill. Depth 0-5 Feet 8
High
Untested. Bluff Edges, Floodplain/Terraces less than 100m from water at elevation of 200-250 meters above sea level. 9
Surface Water
N
W
E
S
0
750
1,500
3,000
Feet
GRC
GLENN RESEARCH CENTER at Lewis Field
NASA
Archaeological Site 33CU514
Abram Creek
Borrow Pit
Unevaluated Site
Unevaluated Site



NASA Glenn Research Center Historic District Map - 2016

SECTION 4: SUPPORTING DOCUMENTATION

This information must be provided for all projects.

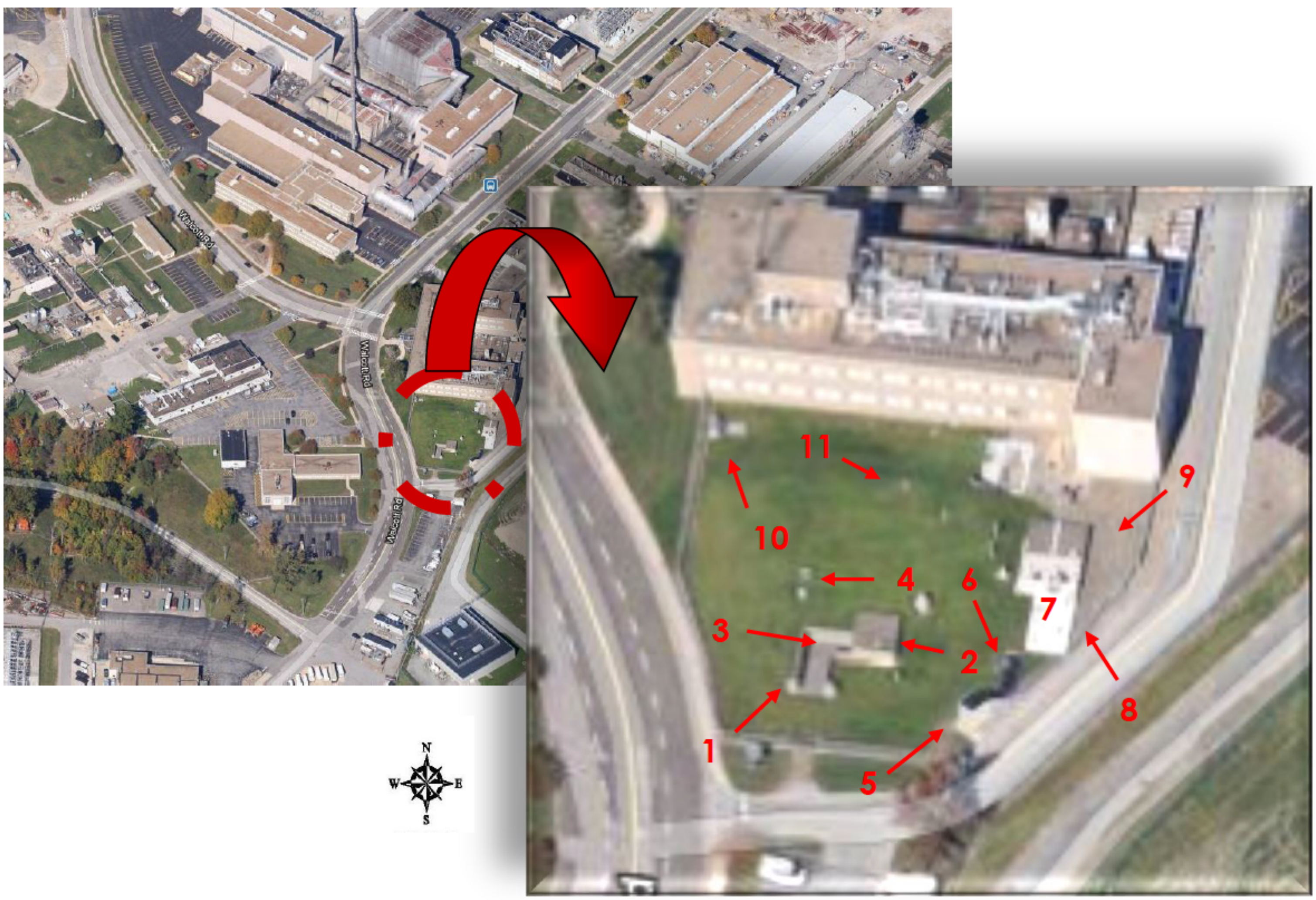
A. Photographs must be keyed to a street-level map, and should be included as attachments to this application. Please label all forms, tables and CDs with the date of your submission and project name, as identified in Section 1. You must present enough documentation to clearly show existing conditions at your project site and convey details about the buildings, structures or sites that are described in your submission. Faxed or photocopied photographs are not acceptable. See Instructions for more info about photo submissions or 36 CFR § 800.11 for federal documentation standards.

   1. Provide photos of the entire project site and take photos to/from historic properties from/towards your project site to support your determination of effect in Section 5.

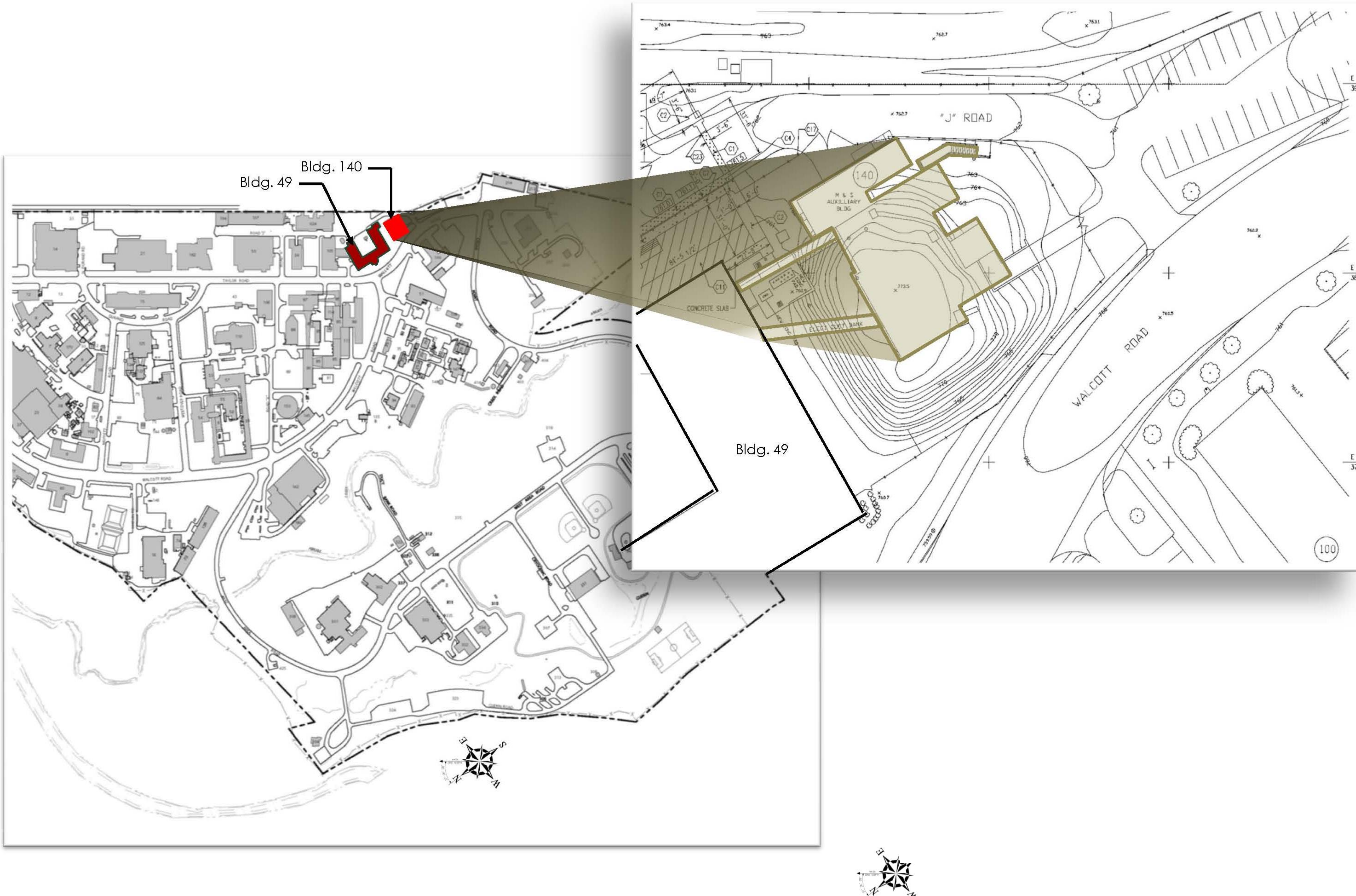
   2. Provide current photos of all buildings/structures/sites described.

B. Project plan, specifications, site drawings and any other media presentation that conveys detailed information about your project and its potential to affect historic properties.

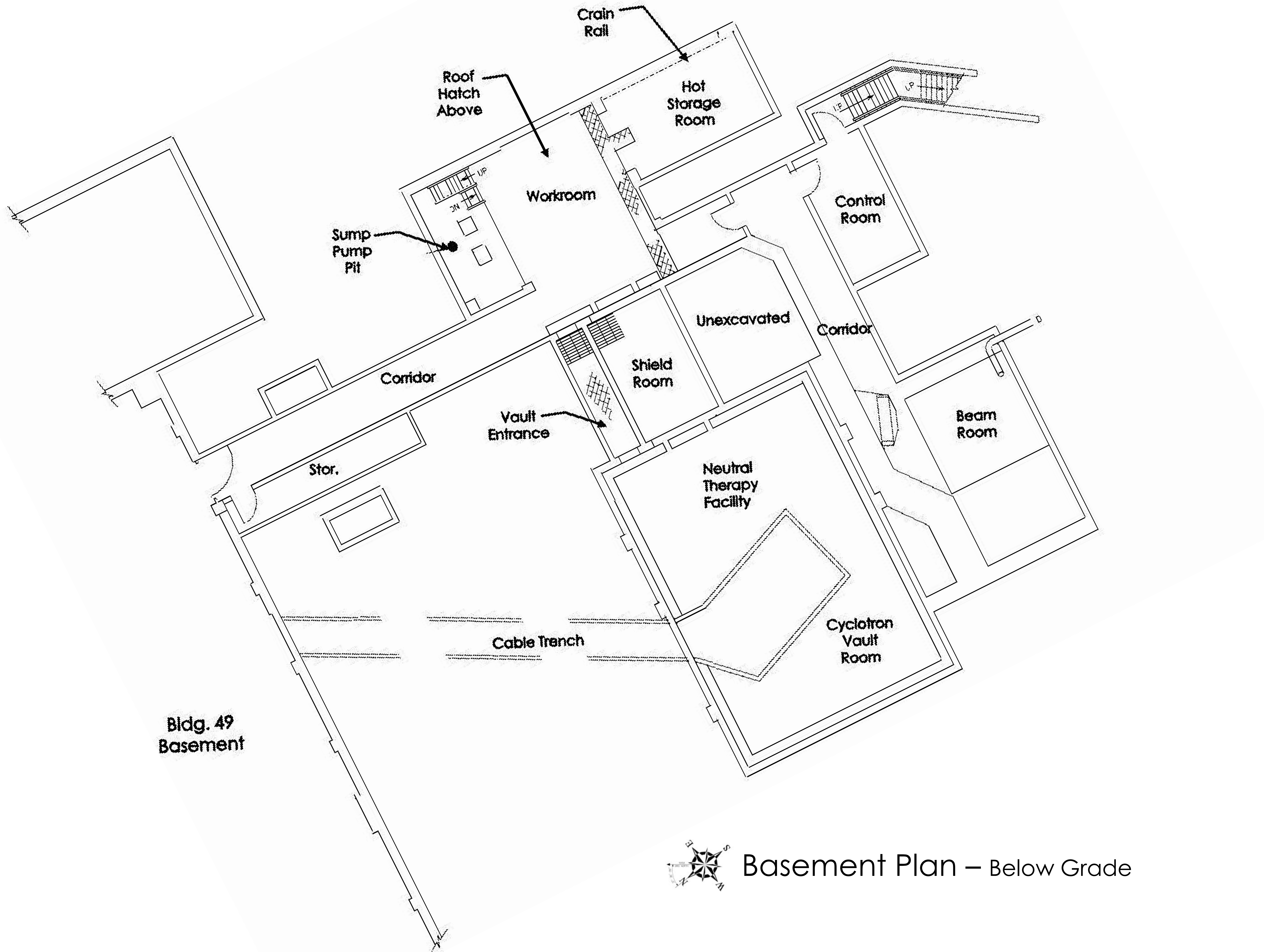
C. Copies or summaries of any comments provided by consulting parties or the public.
No comments received to date.



Photographic Key Plan

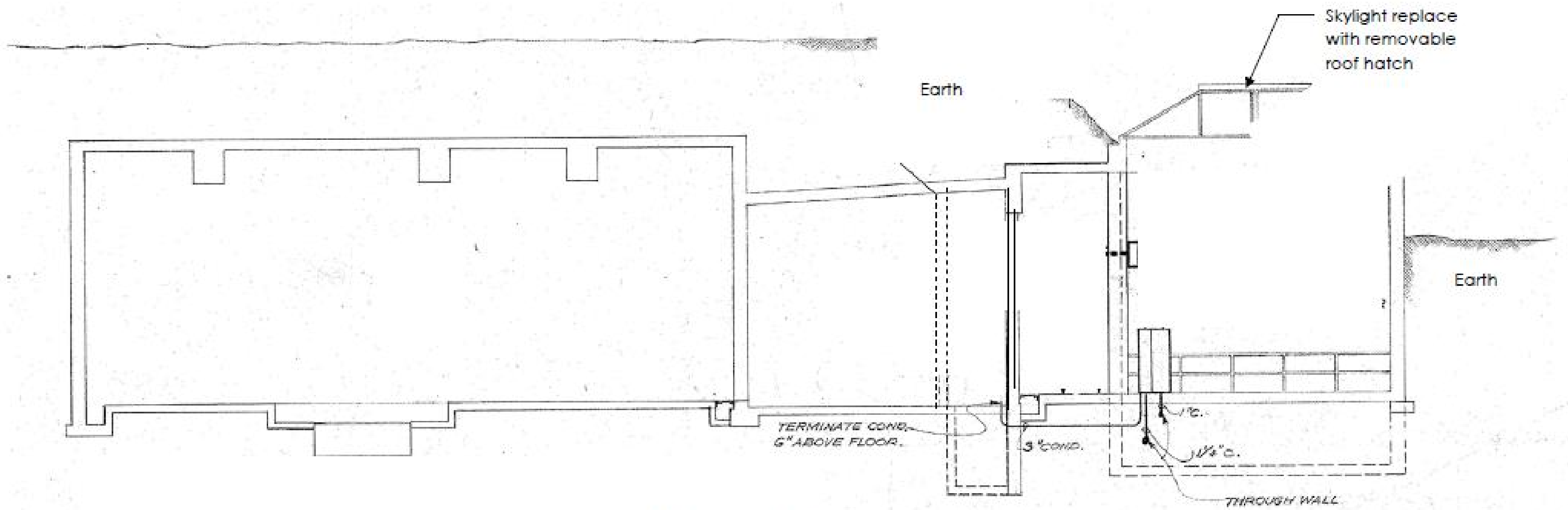

Bldg. 140
Bldg. 49
"J" ROAD
M & S AUXILIARY BLDG
140
CONCRETE SLAB
WALCOTT ROAD
Bldg. 49
100

Site Plan – Above Grade

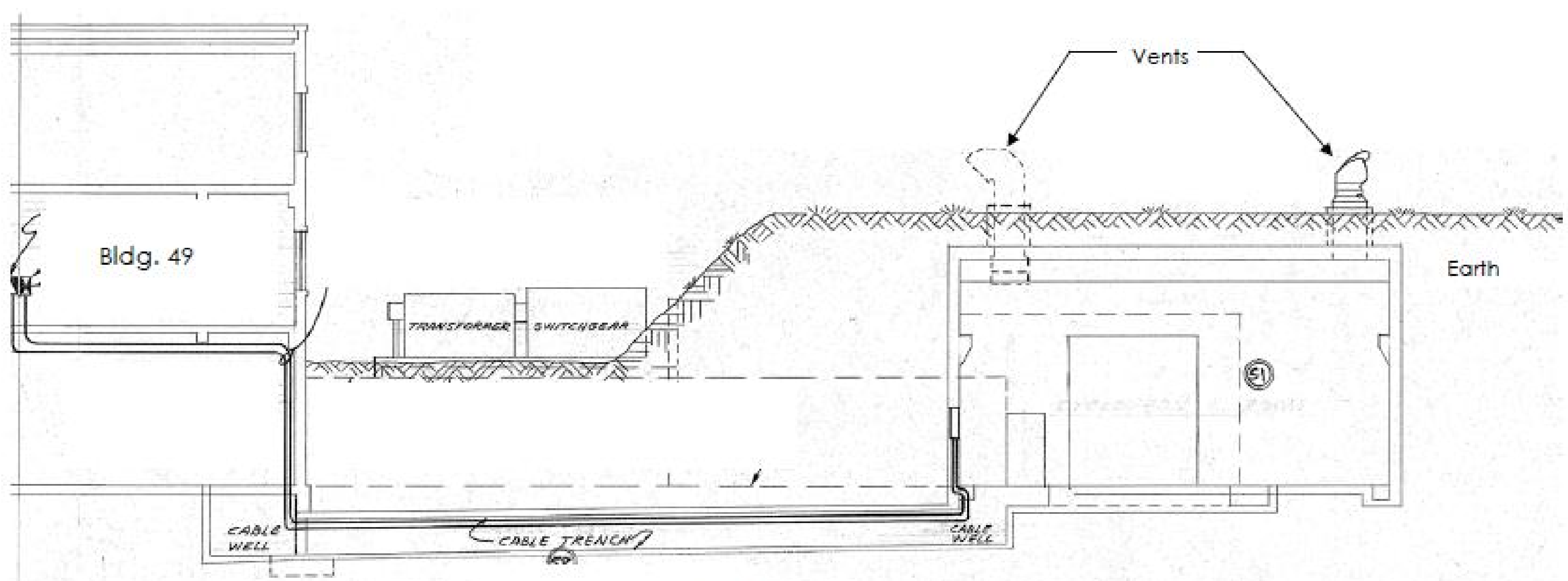


Basement Plan – Below Grade

Aerial View



North - South



West – East

Longitudinal Sections

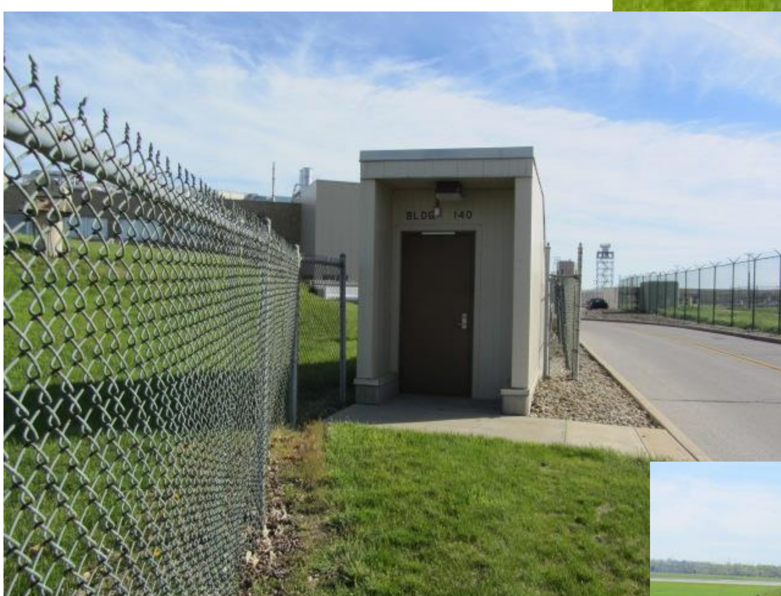
Entry into drive to above ground
Mechanical Room from Walcott Road
Photo 1

Roof top view of Mechanical Room
and retaining walls around drive
Photo 2

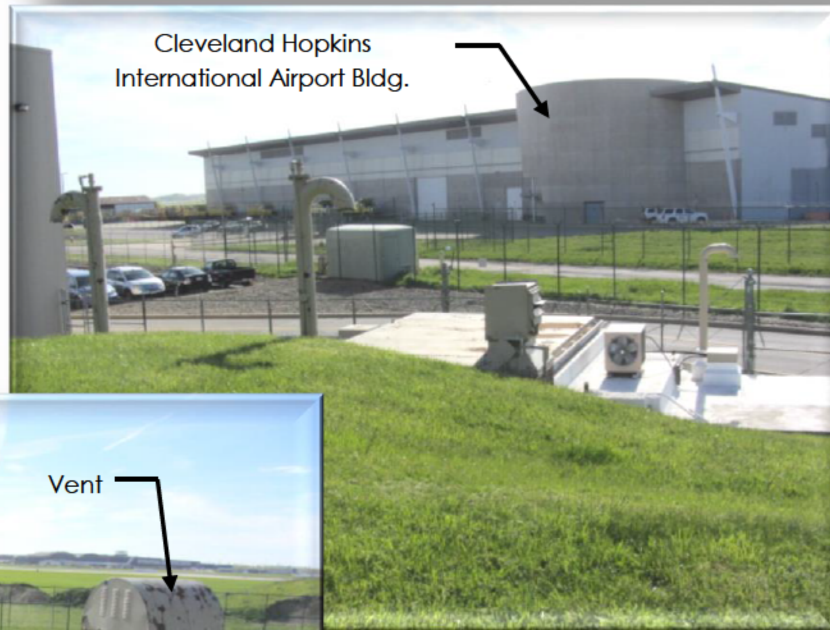
View of above ground Mechanical Room
overhead sectional door
Photo 3

View of A/C Condenser Unit
Photo 4

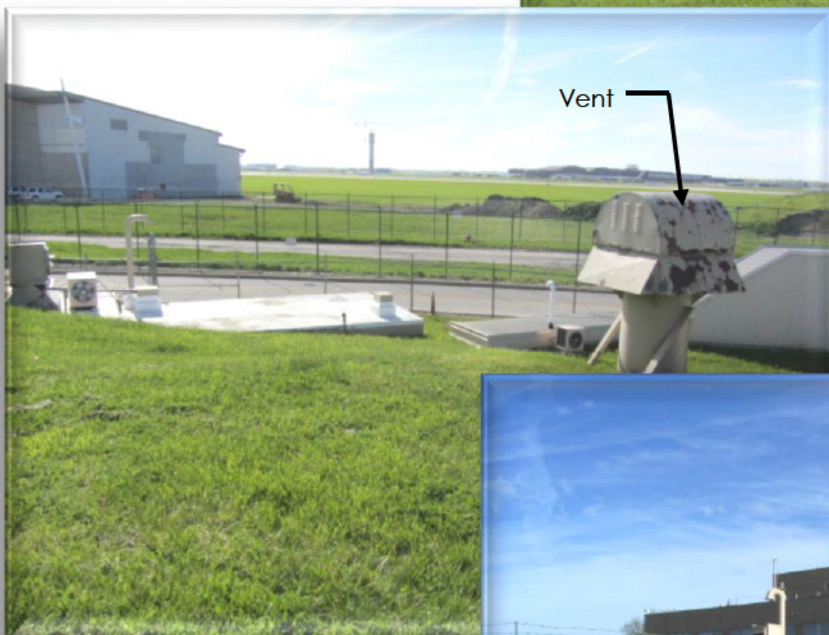
Stair entry into
Cyclotron below
Photo 5



Rear View of
Stair entry into
Cyclotron below
Photo 6



Roof over Sump Pump
Pit, Work Area and Hot
Storage Room
Photo 7



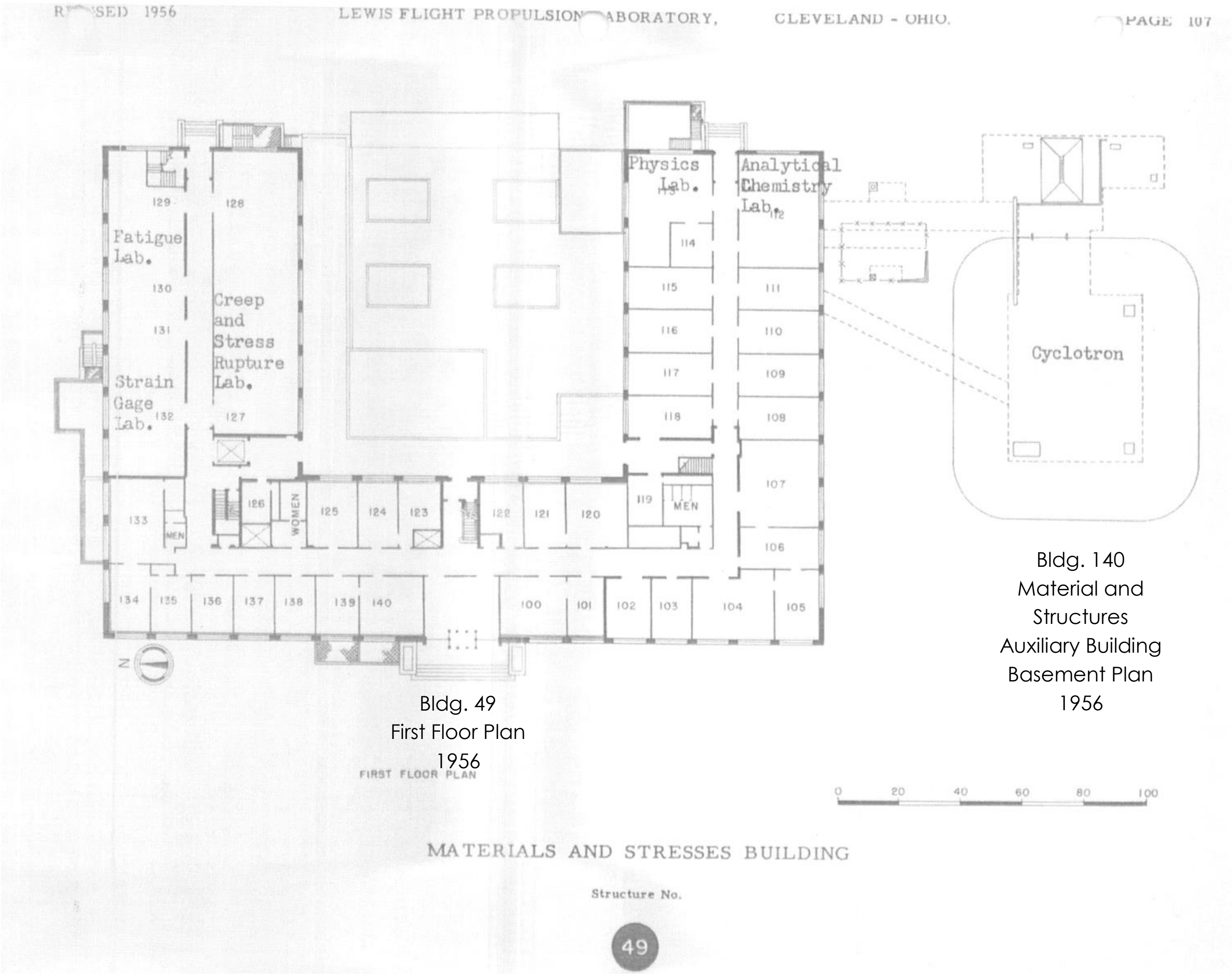
East View of area over
Sump Pump Pit, Work
Area and Hot Storage
Room
Photo 8 and 9

HISTORIC PHOTO
East View over Sump
Pump Pit, Work Area and
Hot Storage Room

Shown here with
Original Skylight

Exhaust Fans from a
Laboratory in Bldg. 49
Photo 10

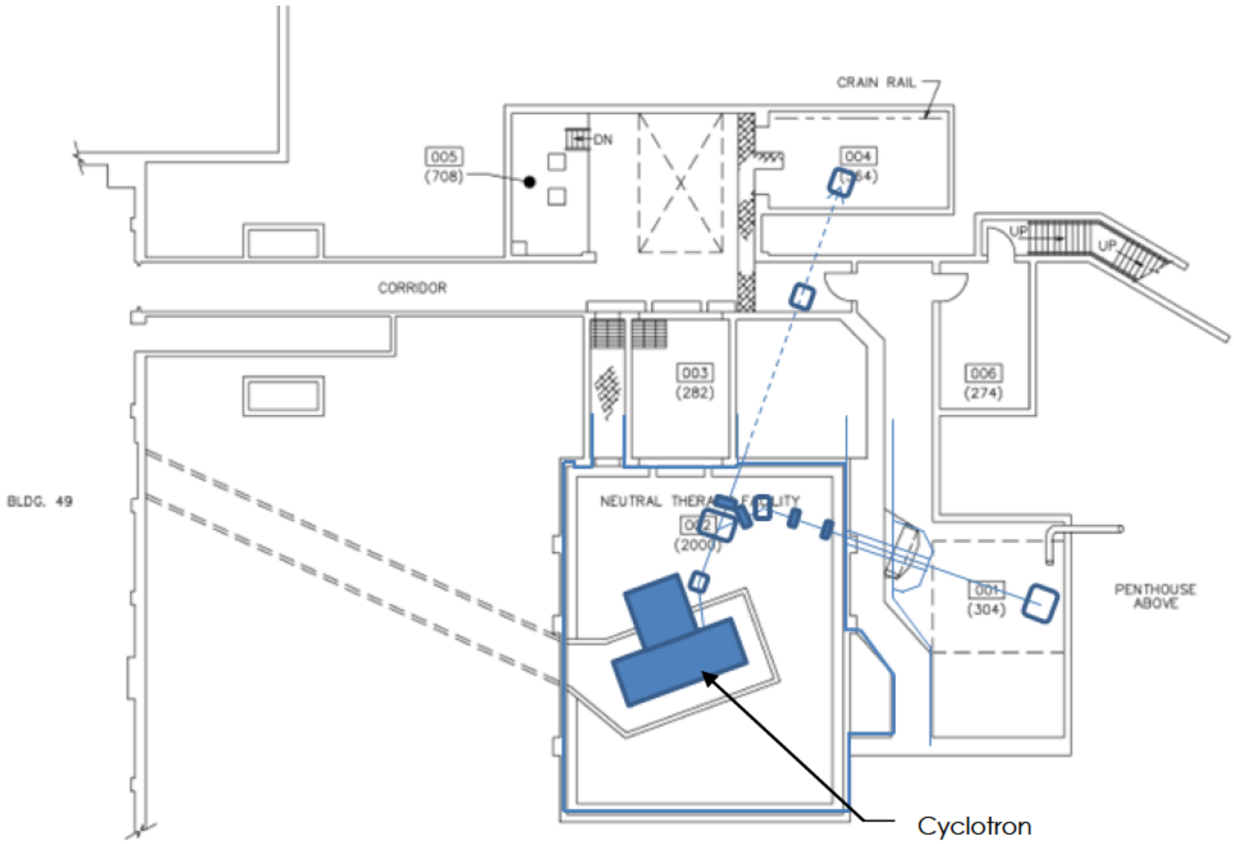
Abandoned Utility Lines
Photo 11



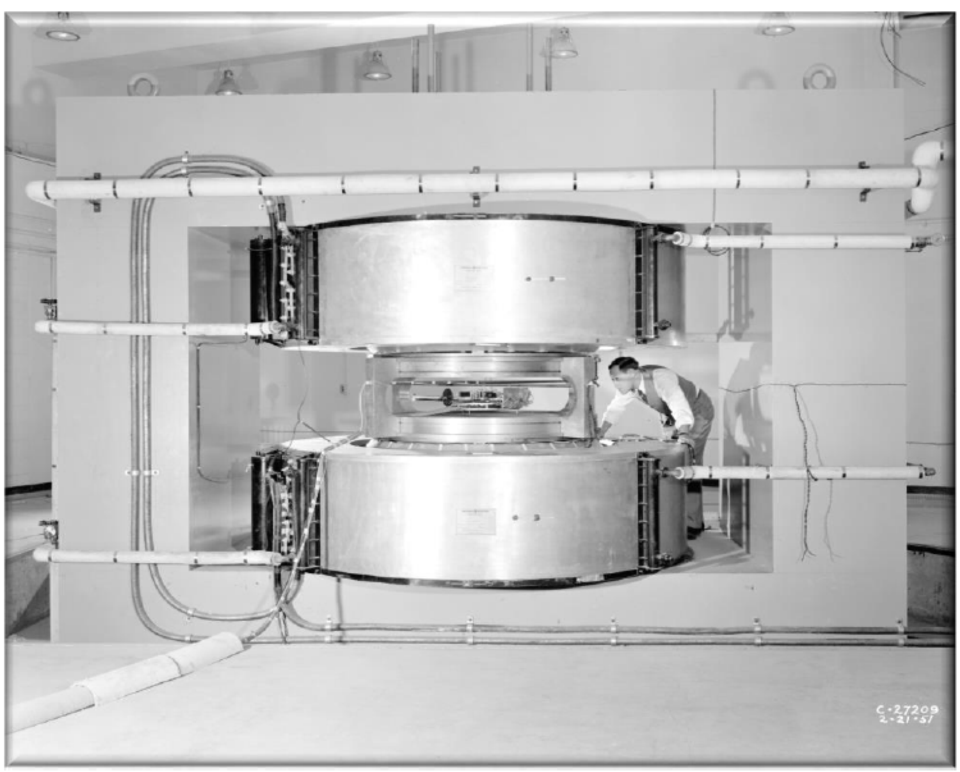
Bldg. 49
First Floor Plan
1956

Bldg. 140
Material and
Structures
Auxiliary Building
Basement Plan
1956

HISTORIC FLOOR PLAN
Building 49
Material and Structures Building



Bldg. 140
Basement Plan



Cyclotron 1951

Cyclotron in the early days

Cyclotron Control Room
in the early days

Cyclotron 1972

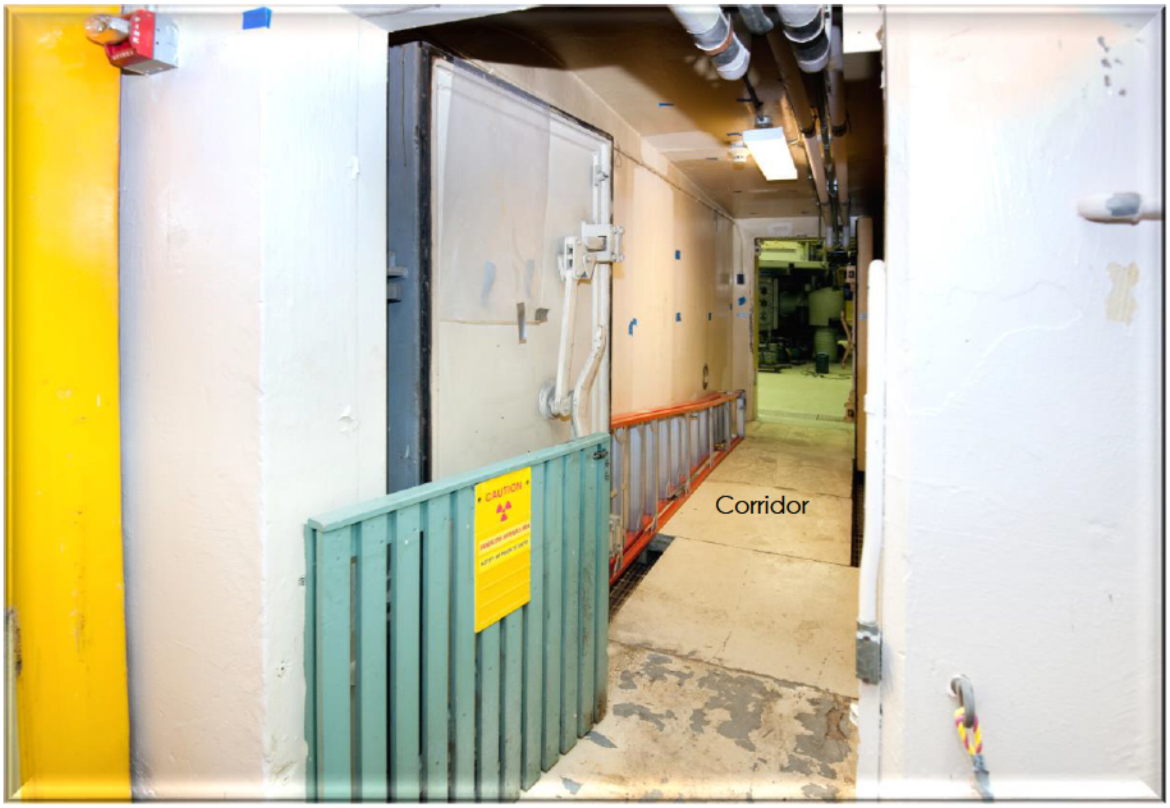
Door into the Vault Room where the Cyclotron is located

Patient Room

Patient station used by Cleveland Clinic

Rear View of Cyclotron

Rear View of Cyclotron



Entry into Cyclotron Facility from Bldg. 49 Basement

SECTION 5: DETERMINATION OF EFFECT

A. Request Preliminary Comments. For challenging projects, provide as much information as possible in previous sections and ask OHPO to offer preliminary comments or make recommendations about how to proceed with your project consultation. This is recommended if your project involves effects to significant historic properties, if the public has concerns about your project's potential to affect historic properties, or if there may be challenging procedural issues related to your project. Please be aware that providing information in all Sections will still be required and that asking OHPO for preliminary comments may tend to delay completion of the review process for some projects.

1. We request preliminary comments from OHPO about this project:
   No

2. Please specify as clearly as possible the particular issues that you would like OHPO to examine for your project (for example- help with developing an APE, addressing the concerns of consulting parties, survey methodology, etc.):
   None

B. Determination of Effect. If you believe that you have gathered enough information to conclude the Section 106 process, you may be ready to make a determination of effect and ask OHPO for concurrence, while considering public comments. Please select and mark one of the following determinations, then explain the basis for your decision on an attached sheet of paper:

☑ **No Historic Properties will be affected** based on 36 CFR § 800.4(d) (1). Please explain how you made this determination:
The demolition of Materials and Structures Auxiliary Building 140, The Cyclotron, has been determined that it has no effect on any historic or potential historically significant property at GRC. The facility is underground and covered with an earthen mound. The structure has never been associated with other historic buildings or structures. The materials and research project that was originated for the Cyclotron was cancelled during the conceptual stage, therefore, no significant research was completed at this facility. Once all decommissioning of all radiation is complete and all materials are removed, the building will be completely empty. The setting, feeling and association will be changed completely and entry into the space will be disallowed.

Additionally, the materials research that was originated in the Cyclotron was continued at NASA's Plum Brook Station Research Reactor, which in 2000, was determined not eligible for listing on the National Register of Historic Places, (NHRP). See the attached letter from the Ohio Historic Preservation Office (OHPO) dated October 30, 2000, in Appendix B

☐ **No Adverse Effect** [36 CFR § 800.5(b)] on historic properties. This finding cannot be used if there are no historic properties present in your project APE. Please explain why the Criteria of Adverse Effect, [36 CFR Part 800.5(a) (1)], were found not to be applicable for your project:

☐ **Adverse Effect** [36 CFR § 800.5(d) (2)] on historic properties. Please explain why the criteria of adverse effect, [36 CFR Part 800.5(a) (1)], were found to be applicable to your project. You may also include an explanation of how these adverse effects might be avoided, reduced or mitigated:

Please print and mail completed form and supporting documentation to:
Ohio Historic Preservation Office
Attn: Mark J. Epstein, Department Head
Resource Protection and Review
1982 Velma Avenue
Columbus, OH 43211-2497

REFERENCES

Gray & Pape, Inc., 2002, OHI forms for Phase 1 Architectural Survey of the NASA Plum Brook Station, Erie County, Ohio (Task 3.1) September 25.

Gray & Pape, Inc., 2002, Predictive Model and Ground-Truthing Survey of Prehistoric and Historic Archaeological Resources at the NASA Plum Brook Station, Perkins, Huron, Milan, and Oxford Townships, Erie County, Ohio (Task 3.2) September 25.

Gray & Pape, Inc. 2006. Cultural Resources Management Plan for NASA Glenn Research Center at Lewis Field and Plum Brook Station. Prepared for NASA/SAIC Environmental Management Branch, Cleveland, Ohio. Gray & Pape Project No. 05-13101

Gray & Pape, Inc. 2008. Cultural Resources Management Plan for NASA Glenn Research Center at Lewis Field and Plum Brook Station. Prepared for NASA/SAIC Environmental Management Branch, Cleveland, Ohio. Gray & Pape Project No. 05-13101

ACRONYMS

ACHP Advisory Council on Historic Preservation
AERL Aircraft Engine Research Laboratory
APE Area of Potential Effects
CRMP Cultural Resource Management Plan
FPO Facility Preservation Officer
GRC Glenn Research Center
HPO Historic Preservation Officer
NACA National Advisory Committee for Aeronautics
NASA National Aeronautics and Space Administration
NRHP National Register for Historic Places
OHI Ohio Historic Inventory
OHPO Ohio Historic Preservation Office

APPENDIX A

Documentation Table

Materials and Structures Auxiliary Building 140

Section 106 Review Project Summary Form Documentation Table
Materials and Structures Auxiliary Building 140

Project Number: 13957

Photo ID	Ref. No. County Quad. Name	Present Name Property Address	UTM Coordinator	Owner Information	Present Use Building Type Architecture Style	Foundation Material Wall Construction Exterior Wall	Year Built / Altered Alterations Current Condition	NRHP Elig.
	13957 Cuyahoga Lakewood	NASA Glenn Research Center Lewis Field 21000 Brookpark Road Cleveland, Ohio 44135		NASA Glenn Research Center Lewis Field 21000 Brookpark Road Cleveland, Ohio 44135	Abandoned Underground Underground	Concrete Concrete Concrete	1949-55 1970-71 Abandoned	No

Additional sources of Information:
The Cyclotron was built to study the strength of materials that had been subject to radioactive particles. These tests would simulate the long term exposure of metals and other materials that aircraft would experience during long duration and high altitude flights. Experience operating and performing experiments with the Cyclotron helped GRC staff gain experience to design and operate the Plum Brook Station Reactor, now decommissioned and demolished.

Further Description **OHI Number:** None
Bldg 140, The Cyclotron, is an underground complex located adjacent to Bldg. 49, Materials and Structures Laboratory on the south. It is tucked in the southwest corner of the central section of the campus. The underground facility extends below grade approximately 18'-0" and above grade approximately 11'-0" with and additional 3'-0" of earth covering creating a mound. Grass seed was planted over the mound so it would blend in with the other lawns on campus.
The Cyclotron Facility was designed, manufactured, constructed and installed by General Electric from 1949 to 1955. The Cyclotron was a 60" frequency that produced 21-mega-electron-volt deuterons and 42 mega-electron volt alpha particles. It was built completely out of concrete: floors, wall and ceilings, all 1'-0" thick or more. The Cyclotron performed a variety of irradiation experiments. The activities included radiation damage studies, general nuclear physics research, and some production of radioisotopes by bombardment of targets.

Preparer Information:
Leslie Main
Historic Preservation Officer

APPENDIX B

2014 Ohio Historic Inventory (OHI)

OHIO HISTORY

Ohio Historic Preservation Office

800 E. 17th Avenue
Columbus, OH 43211
614/298-2000

OHIO HISTORIC INVENTORY

Section 106/RPR Review:

RPR Number:

1. No. CUY0997508 **REV**

4. Present Name(s): **NASA GRC Lewis Field Maintenance and Repairs Building**

2. County: **Cuyahoga**

5. Historic or Other Name(s): **Building 107**

6. Specific Address or Location:
21000 Brookpark Rd

6a. Lot, Section or VMD Number:

7. City or Village:
Cleveland

9. U.T.M. Reference
Quadrangle Name: Lakewood

Zone: 17 Easting: 427869 Northing: 4584494

10. Classification: Building

11. On National Register? NO

13. Part of Established Hist. Dist? NO

15. Other Designation (NR or Local)

16. Thematic Associations:
Science Research

17. Date(s) or Period:
1964

17b. Alteration Date(s):

18. Style Class and Design:
None
No academic style - Vernacular

18a. Style of Addition or Elements(s):

19. Architect or Engineer:

19a. Design Sources:

20. Contractor or Builder:

21. Building Type or Plan: Other Building Type

22. Original Use, if apparent:
Research Facility

23. Present Use:
Research Facility

24. Ownership:

25. Owner's Name & Address, if known:
NASA Glenn Research Center
21000 Brookpark Road
Cleveland, OH 44135

26. Property Acreage:

27. Other Surveys:

28. No. of Stories: Two story

29. Basement?

30. Foundation Material: Poured concrete

31. Wall Construction:
Metal/steel frame

32. Roof Type:
Gable
Roof Material:
Metal

33. No. of Bays: Side Bays:

34. Exterior Wall Material(s):
Sheet metal

35. Plan Shape: Rectangular

36. Changes associated with 17/17b Dates:
17. Original/Most significant construction

17b.

37. Window Type(s):
Plate Glass

38. Building Dimensions: 345 by 70 Feet

39. Endangered? NO
By What?

40. Chimney Placement:

41. Distance from & Frontage on Road:
15 Feet from J Road

51. Condition of Property: Good/Fair

52. Historic Outbuildings & Dependencies
Structure Type(s):

Date(s):

Associated Activity:

53. Affiliated Inventory Number(s):
Historic (OHI):

Archaeological (OAI):

2. County: Cuyahoga

4. Present or Historic Name(s): **NASA GRC Lewis Field Maintenance and Repairs Building**

6. Specific Address or Location: **21000 Brookpark Rd**

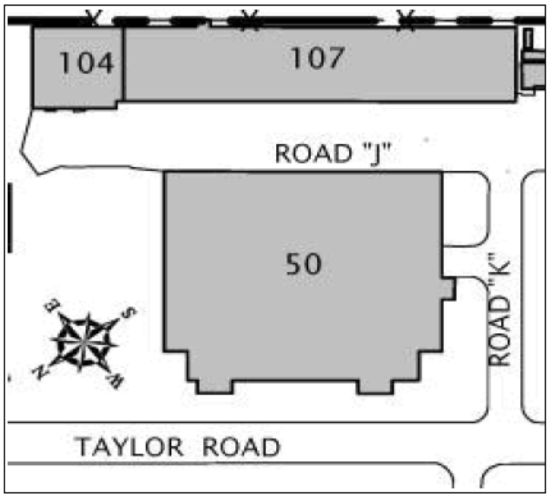
8. Site Plan (location map) with North Arrow

46. Prepared By: **Brian Avery**
49. PIR Reviewer: **CS/SMT**

47. Organization: **k2m Design**

48. Date Recorded: **11/25/2013**
50. PIR Review Date: **02/19/2014**

1. No. CUY0997508	4. Present Name(s): NASA GRC Lewis Field Maintenance and Repairs Building
2. County Cuyahoga	5. Historic or Other Name(s): Building 107



Door Selection:
Door Position:
Orientation: Other
Symmetry:

Report Associated With Project:

Primary Author	Secondary Author(s)	Year	Title
k2m Design	Brian Avery	2013	NASA GRC Lewis Field 2013 OHI Forms

42. Further Description of Important Interior and Exterior Features

Building 107, the Maintenance and Repairs Building, is a 26,000 SF, two-story, rectangular plan steel structure with a shallow pitched gable roof and clad with dark tan vertical metal siding. Building 104, a garage and repair shop, is attached to the facility's northeast end. Thirteen garage doors of varying heights punctuate the northwest wall (facing J Road), and the elevation's four single metal door entrances are protected by small metal canopies – one door and canopy is set in a garage door. The five window systems on the northwest elevation are single pane metal windows split by mullions into two panes by three panes, and are stand alone or in a series of two or three. A pair of second story windows is located central to the northwest facade - serving a small group of offices. Other than the central offices, the majority of Building 107 is two-story high open space. The southwest facade consists of a long band of windows in the same style and size as the northwest facade, although consisting of 11 windows, alongside a single metal door on the elevation's left side. On the rear (southeast elevation) of the facility there are seventeen window openings which either stand alone or are in a series of two or three – similar to the northwest facade.

43. History and Significance

The National Advisory Committee on Aeronautics (NACA) dedicated its 199.7 acre Cleveland research center in 1943 as the Aircraft Engine Research Laboratory (AERL) – created to be a national resource capable of providing innovations in aircraft engine technology, and transitioning these innovations to U.S. industry for use in future propulsion system designs for commercial and military applications. In 1948, the center was renamed the Lewis Flight Propulsion Laboratory after George W. Lewis, who had been the NACA director of aeronautical research from 1924 to 1947. The Lewis Flight Propulsion Laboratory served as the propulsion research center of NACA until 1958, when the lab became part of the newly formed National Aeronautics and Space Administration (NASA) and renamed Lewis Research Center. In 1999, the lab was renamed Glenn Research Center at Lewis Field, in honor of astronaut and Senator John H. Glenn, and today the center covers 351.32 acres of land. As the center was conceived in 1943, the men and women at Glenn Research Center continue their aeronautical research while advancing technologies in aerospace propulsion and space flight systems. Previously known as the Cryogenic Equipment and Vehicle Repair Building until 1986, Building 107 is now called the Maintenance and Repairs Building. The facility houses vehicle maintenance and repair activities, staff and supplies in support of research throughout the GRC.

44. Description of Environment and Outbuildings (See #52)

Building 107, attached to Building 104 on Building 104's southwest end, is located between J Road and the Cleveland Hopkins International Airport. A narrow grass lawn and security fence separates Building 107 from the airport along the facility's southeast elevation. Paved parking makes up the remaining site around the facility. In addition, a rectangular building with an overhanging gable roof and tan vertical metal siding (numbered "117") is located a few feet from the southwest side of Building 107.

45. Sources of Information

NASA GRC Plans of Buildings and Structures, Real Property Division, Overall Cultural Resource Reconnaissance Survey of NASA Lewis Research Center Cleveland, Ohio by Gray and Pape 1996, Interviews with GRC Historic Preservation Office representatives.

APPENDIX C

Letter from Ohio Historic Preservation Office (OHPO) regarding NASA Plum Brook Station Reactor Facility, Sandusky, Ohio

Ohio Historic Preservation Office

567 East Hudson Street
Columbus, Ohio 43211-1030
614/ 298-2000 Fax: 614/ 298-2037

Visit us at www.ohiohistory.org/resource/histpres/

OHIO HISTORICAL SOCIETY
SINCE 1885

October 30, 2000

Joseph Morris
GRC Facility Preservation Officer
NASA Glenn Research Center
Lewis Field
Cleveland, OH 44135-3191

Dear Mr. Morris:

Re: NASA Plum Brook Reactor Facility, Sandusky, Ohio

This letter is in response to your correspondence, received on July 5, 2000. We apologize for the delay in our response and offer comments pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

We have reviewed the information that you submitted regarding the Plum Brook Reactor Facility. Based on that information, as well as some additional contextual information from the U.S. Department of Energy report "Linking Legacies", it is my opinion that this property is not eligible for listing on the National Register of Historic Places. Therefore, we concur with your determination that the proposed decommissioning will not affect historic properties. No further coordination with this office is necessary, unless there is a change in the project.

If you have any questions about this letter or our review of this project, please call Lisa Adkins at (614) 297-2470. Thank you for your cooperation.

Sincerely,

Mark J. Epstein

Mark Epstein, Department Head
Resource Protection and Review

MJE/LAA: la

Post-it® Fax Note 7671	Date 10/30/00	# of pages ▶ 1
To JOE MORRIS	From LISA ADKINS	
Co./Dept. NASA	Co. OHPO	
Phone #	Phone #	
Fax # (216) 433-3124	Fax #	

TOTAL P.01

APPENDIX D

NASA Environmental Assessment
Decontamination and Decommissioning of Building 140 at Glenn Research Center
Lewis Field

National Aeronautics and Space Administration

Environmental Assessment

Decontamination and Decommissioning of Building 140 at Glenn Research Center Lewis Field

April 2015

ENVIRONMENTAL ASSESSMENT
DECONTAMINATION AND DECOMMISSIONING OF BUILDING 140
AT GLENN RESEARCH CENTER LEWIS FIELD

National Aeronautics and Space Administration
Glenn Research Center
Lewis Field
Cleveland, OH 44135

Lead Agency: National Aeronautics and Space Administration (NASA)

Proposed Action: Implement and complete the decontamination and decommissioning of Building 140, known as the Cyclotron Facility.

For Further Information:

Robert F. Lallier
NEPA Manager
NASA Glenn Research Center
Energy and Environmental Management Office
21000 Brookpark Road, Mail Stop 21-2
Cleveland, OH 44135
(419) 621-3234

Date: April 2015

Abstract: NASA is proposing to implement and complete the decontamination and decommissioning of Building 140, known as the Cyclotron Facility, at the NASA Glenn Research Center. Limited decontamination and removal of equipment was accomplished between 1991 and 1994 to permit the reuse of ancillary spaces in Building 49, the Materials and Structures Laboratory (which connects to Building 140) and to provide environmental stabilization of Building 140 for long-term decay in storage. This environmental assessment analyzes the environmental consequences of the Proposed Action to decontaminate and decommission the Cyclotron Facility, which would essentially restore the site to pre-construction conditions, and the No Action Alternative. Cumulative impacts are also evaluated.

This page left intentionally blank.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

This page left intentionally blank.

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
dB	decibel
dBA	A-weighted decibel
DCGL	derived concentration guideline level
DNL	day–night average sound level
DOT	U.S. Department of Transportation
EA	environmental assessment
FONSI	Finding of No Significant Impact
FSS	Final Status Survey
FY	fiscal year
GE	General Electric
GHG	greenhouse gas
GRC	Glenn Research Center
LCF	latent cancer fatality
LLW	low-level radioactive waste
MeV	megaelectron-volts
NAAQS	National Ambient Air Quality Standards
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OHPO	Ohio Historic Preservation Office
OSHA	Occupational Safety and Health Administration
PM_n	particulate matter with an aerodynamic diameter less than or equal to n micrometers
RADTRAN 6	Radioactive Material Transportation Risk Assessment Code 6
RCRA	Resource Conservation and Recovery Act
TRAGIS	Transportation Routing Analysis Geographic Information System

TWA	time-weighted average
U.S.C.	*United States Code*
VOC	volatile organic compound

MEASUREMENT UNITS

The principal measurement units used in this document are SI units (the abbreviation for the Système International d'Unites). The SI system is an expanded version of the metric system that was accepted in 1966 in Elsinore, Denmark, as the legal standard by the International Organization for Standardization. In this system, most units are made up of combinations of seven basic units, of which length in meters, mass in kilograms, and volume in liters are of most importance. Exceptions are radiological units that use the English system (e.g., rem, millirem).

SCIENTIFIC (EXPONENTIAL) NOTATION

Numbers that are very small or very large are often expressed in scientific, or exponential, notation as a matter of convenience. For example, the number 0.000034 may be expressed as 3.4×10^{-5} or 3.4E-05, and 65,000 may be expressed as 6.5×10^{4} or 6.5E+04.

Multiples or submultiples of the basic units are also used. A partial list of prefixes that denote multiples and submultiples follows, with the equivalent multiplier values expressed in scientific notation.

Prefix	Symbol	Multiplier	
atto	a	0.000 000 000 000 000 001	1×10^{-18}
femto	f	0.000 000 000 000 001	1×10^{-15}
pico	p	0.000 000 000 001	1×10^{-12}
nano	n	0.000 000 001	1×10^{-9}
micro	μ	0.000 001	1×10^{-6}
milli	m	0.001	1×10^{-3}
centi	c	0.01	1×10^{-2}
deci	d	0.1	1×10^{-1}
deka	da	10	1×10^{1}
hecto	h	100	1×10^{2}
kilo	k	1,000	1×10^{3}
mega	M	1,000,000	1×10^{6}
giga	G	1,000,000,000	1×10^{9}
tera	T	1,000,000,000,000	1×10^{12}
peta	P	1,000,000,000,000,000	1×10^{15}
exa	E	1,000,000,000,000,000,000	1×10^{18}

The following symbols are occasionally used in conjunction with numerical expressions:

<	less than
≤	less than or equal to
>	greater than
≥	greater than or equal to

CONVERSIONS

English to Metric			Metric to English		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092903	square meters	square meters	10.7639	square feet
square yards	0.8361	square meters	square meters	1.196	square yards
acres	0.40469	hectares	hectares	2.471	acres
square miles	2.58999	square kilometers	square kilometers	0.3861	square miles
Length			**Length**		
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Temperature			**Temperature**		
degrees Fahrenheit	Subtract 32, then multiply by 0.55556	degrees Celsius	degrees Celsius	Multiply by 1.8, then add 32	degrees Fahrenheit
Volume			**Volume**		
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight			**Weight**		
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons

EXECUTIVE SUMMARY

The National Aeronautics and Space Administration's (NASA's) Glenn Research Center (GRC) needs to amend its radioactive license with the U.S. Nuclear Regulatory Commission (NRC) by decommissioning the Cyclotron Facility, reduce the burden of facility surveillance, maintenance and monitoring activities, and reduce the inventory of surplus facilities. In support of these needs, NASA proposes to complete the decontamination and decommissioning of Building 140, also known as the Cyclotron Facility, which has been radioactively impacted and no longer serves a useful purpose for research and development.

The Proposed Action and the No Action Alternative are analyzed in this *Environmental Assessment for the Decontamination and Decommissioning of Building 140 at GRC Lewis Field* (*Cyclotron EA*).

No Action Alternative: Building 140 would remain in place and no additional decontamination or decommissioning would occur. This course of action would require that GRC amend its NRC license requesting that no decommissioning of the Cyclotron Facility be performed, contrary to NRC regulations. Long-term surveillance and maintenance would continue indefinitely and minimal utility service would be provided to the facility.

Cyclotron Removal with Decontamination, Decommissioning and Demolition (Proposed Action): The cyclotron machine and all ancillary equipment would be removed from Building 140, and all above- and below-grade structures would be demolished. A Final Status Survey would be prepared to support unrestricted release of the facility from GRC's radioactive license with the NRC. The property would be backfilled to its original grade and landscaped.

Environmental impacts evaluated in this *Cyclotron EA* were determined to range from none to negligible. Resource areas evaluated as not having the potential for adverse impacts under the Proposed Action include land use, visual resources, geology and soils, ecological resources, cultural resources, utilities infrastructure, socioeconomics, and environmental justice. Resource areas that have the potential for some, but still negligible, adverse impacts include air quality, noise, water resources, waste management, transportation, and health and safety. Implementing best management practices and maintaining compliance with Federal, state, and local environmental laws and regulations will ensure adverse impacts remain negligible for these resource areas.

NASA consulted with the Ohio Historic Preservation Office, as required by Section 106 of the National Historic Preservation Act; however, Building 140 is not a contributing element to GRC's historic district and it does not have any other historical significance.

The public was notified of an opportunity to review and comment on the draft *Cyclotron EA* via announcements in local newspapers and a posting on NASA's National Environmental Policy Act (NEPA) website (http://www.nasa.gov/agency/nepa). NASA received no comments during the 30-day comment period. This final *Cyclotron EA* is available on NASA's NEPA websites, http://www.nasa.gov/agency/nepa and http://netspublic.grc.nasa.gov.

This page left intentionally blank.

1. PURPOSE AND NEED FOR THE ACTION

1.1 INTRODUCTION

This *Environmental Assessment for the Decontamination and Decommissioning of Building 140 at GRC Lewis Field* (*Cyclotron EA*) has been prepared by the National Aeronautics and Space Administration (NASA) to assist in the decision making process in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* [U.S.C.] 4321 et seq.); the Council on Environmental Quality's NEPA implementing regulations (Title 40 of the *Code of Federal Regulations*, Parts 1500–1508 [40 CFR Parts 1500–1508]); and NASA's NEPA regulations (14 CFR 1216.3). This environmental assessment (EA) considers the environmental impacts associated with implementation of the Proposed Action to decontaminate and decommission Building 140 at NASA's Glenn Research Center (GRC) – Lewis Field, known as the Cyclotron Facility. A No Action Alternative is also considered. Decontamination, decommissioning, and demolition activities discussed in this EA would not begin until the necessary Federal, state, and local permits and approvals have been obtained.

1.2 BACKGROUND

The NASA GRC facilities have their origin in 1941, when construction began on the National Advisory Committee for Aeronautics (NACA) Aircraft Engine Research Laboratory near Cleveland, Ohio. Construction was on a 142 hectare (351 acre) site of land acquired from the City of Cleveland at the southwest boundary of the city (SAIC 2012).

In the late 1940s, General Electric (GE) began construction of the Cyclotron Facility under a 'turn-key' agreement with NACA. In 1955, after about seven years of construction, the 152-centimeter (60-inch) cyclotron became operational and was turned over to NACA for materials research. It was used in performing material irradiation studies. The system was a charged-particle accelerator capable of accelerating alpha particles to energies of 40 megaelectron-volts (MeV) and protons and deuterons to energies of 20 MeV. The system operated extensively until 1970, when it was shut down to perform a significant upgrade to the machine. Dismantlement of the old cyclotron equipment was performed from October of 1970 until July of 1971, when installation of the modified equipment began. Work continued on the upgrade installation until January of 1973, when startup testing began. The modified system was a 175-centimeter (69-inch) cyclotron with the capability of producing variable energy. It was a more versatile system capable of accelerating alpha particles to energies of 24 to 58 MeV, protons to energies of 10 to 55 MeV, deuterons to energies of 7 to 29 MeV, and helium-4 nuclei to energies of 15 to 65 MeV. In addition, the system could produce neutron beams that follow a parallel path by bombardment of beryllium target materials. The modified machine had a much higher efficiency, meaning that less particle impingement would occur inside the machine, resulting in less radioactive activation of the materials of construction.

In 1975, the facility was modified to prepare for treatment of oncology patients under a program with the Cleveland Clinic Foundation. The building was remodeled to provide for a patient receiving area, and additional particle-beam control systems were installed to allow generation of collimated neutron beams in a patient treatment center. From 1975 through 1990, treatment of oncology patients continued until the Cyclotron Facility was permanently shut down in December of 1990, after treating about 1,200 patients (SAIC 2012).

Throughout the operational period, cyclotron operations were carefully controlled by written procedures and policies and a written safety manual. The operations were subjected to extensive review and oversight by GRC's Radiation Safety Committee, made up of senior management personnel with extensive technical expertise in the areas of health physics and radiation protection. The same health physics technical staff that performed radiation monitoring and safety activities throughout the GRC also provided monitoring and radiation protection activities at the cyclotron (SAIC 2012).

In 1991, NASA implemented a plan to decontaminate the Cyclotron Facility. The plan included decontamination of laboratories and rooms in Building 49, the Materials and Structures Laboratory, which connects at the basement level with Building 140; decontamination of adjacent rooms in Building 140 and conversion for use by the Health Physics staff; and closure of the cyclotron itself for decay-in-storage status. In 1994, NASA planned a major renovation to Building 49 to establish the Comparative Technology Research Center. Decontamination was performed under the supervision and oversight of radiation protection personnel. Nearly all of the loose radioactive material in the facility was packaged and shipped for disposal as radioactive waste. When the project was completed in late 1994, Building 140 was left secured to allow further radioactive decay of the cyclotron and the beam equipment. Affected areas of Building 49 were decontaminated and released for unrestricted use before beginning the Building 49 renovation project (SAIC 2012).

The cyclotron machine itself was contaminated with activation products and the decision was made to proceed with dismantlement at the time. The magnet coils and other beam control components were supplied with a source of de-ionized water for cooling. Records indicate that complete drainage of the cooling system could not be confirmed. It was drained to the extent practical by opening the accessible drain valves. During storage, the cyclotron area has been subjected to frequent radiological monitoring and physical inspection. Maintenance has been performed to assure the continuation of reasonably good ventilation and heat in the area (SAIC 2012).

A chronology of major milestones is provided below. Emphasis is on operations with radioactive materials that could affect the facility conditions (SAIC 2012).

- Late 1940s – GE began construction of the 152-centimeter (60-inch) cyclotron.
- 1955 – Cyclotron operations began after seven years of construction.
- 1955 through 1970 – Cyclotron was used extensively for material irradiation studies, general nuclear physics research, and some production of radioisotopes by bombardment of targets.
- October 1970 through July 1971 – Significant upgrade to the cyclotron was performed. The 152-centimeter (60-inch) cyclotron was disassembled and replaced by a more efficient 175-centimeter (69-inch) cyclotron. Testing and research resumed following the upgrade.
- 1975 – Facility modifications were performed to prepare for treatment of Cleveland Clinic oncology patients through neutron radiation therapy.
- 1975 through 1990 – Cyclotron operations continued. A majority of the run time was dedicated to treatment of oncology patients. However, records indicate some production of radioisotopes occurred for medical administration to human patients.

- December 1990 – Cyclotron operations were terminated.
- 1991 – Facility decontamination plan was implemented, which included some removal of unnecessary equipment/materials, general decontamination of laboratories and impacted rooms located in Buildings 49 and 140, and closure of the cyclotron for decay-in-storage status.
- 2014 – NEPA review was initiated for the Proposed Action of completing the decontamination, decommissioning, and demolition of Building 140.

1.3 PURPOSE AND NEED

The purpose of NASA's action to decontaminate and decommissioning Building 140 is to amend and remove the licensed radioactive materials associated with the Cyclotron Facility from GRC's U.S. Nuclear Regulatory Commission (NRC) byproduct materials license. In accordance with the Energy Policy Act of 2005 (42 U.S.C. 15801 et seq.), wherein the NRC revised its definition of byproduct material, the activated components and materials of the cyclotron and beam control systems along with the activated infrastructure became NRC-licensed byproduct material as of October 2008 and were listed on NASA GRC's License No. 34-00507-16. The Proposed Action would also allow NASA to reduce the burden of surveillance, maintenance, and monitoring costs and to reduce its surplus facilities inventory. Upon completion of the Proposed Action, NASA GRC's NRC license would still be in effect for other radioactive byproduct materials used for research at Lewis Field that are not associated with the Cyclotron Facility.

Decommissioning of the Cyclotron Facility is required to be completed in accordance with the NRC regulation "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas" (10 CFR 30.36). NASA GRC has been working with, and, submitting appropriate licensing actions to NRC Region III to adjust the time schedule for decommissioning process milestones as needed to address the scope and complexity of the project as well as resource availability at GRC.

This page left intentionally blank.

2. PROPOSED ACTION AND NO ACTION ALTERNATIVE

This chapter describes Building 140, known as the Cyclotron Facility; the Proposed Action evaluated in this *Environmental Assessment for the Decontamination and Decommissioning of Building 140 at GRC Lewis Field* (*Cyclotron EA*); and the No Action Alternative.

2.1 DESCRIPTION OF CYCLOTRON FACILITY

NASA GRC consists of two sites in Ohio: Lewis Field in western Cuyahoga County (near Cleveland) and Plum Brook Station in west-central Erie County, approximately 6 kilometers (4 miles) south of Sandusky, Ohio, and 81 kilometers (50 miles) west of Lewis Field. Building 140 is located at GRC Lewis Field as illustrated in **Figure 2–1**. Building 140 is made up of approximately 560 square meters (6,000 square feet) of floor space and the Cyclotron Facility project area encompasses approximately 0.3 hectares (0.7 acres). Building 140 interconnects at the basement level with Building 49, the Materials and Structures Laboratory, via an access corridor and a service trench. Building 140 is not currently occupied and all research activities using the Cyclotron Facility and its equipment have ceased. Building 140 is primarily a below-grade structure. Above-grade structures include ventilation hoods, exposed roof above the Hot Storage Room, the Skylight Room access panels, a stairway entrance, and the Mechanical Equipment Room. The above- and below-grade details of Building 140 are illustrated in **Figures 2–2** and **2–3**, respectively.

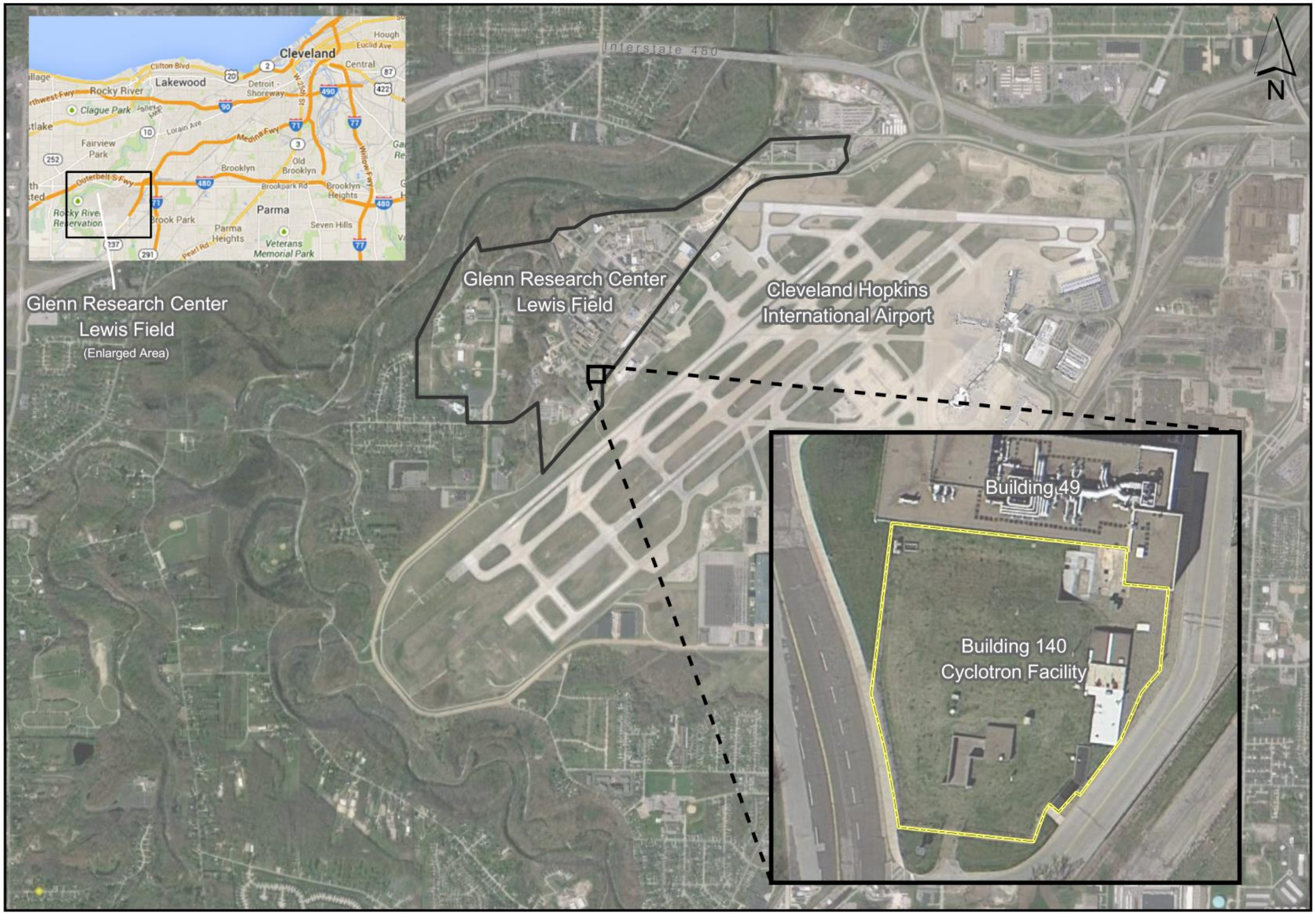


Figure 2–1. Location of Building 140 at Glenn Research Center Lewis Field

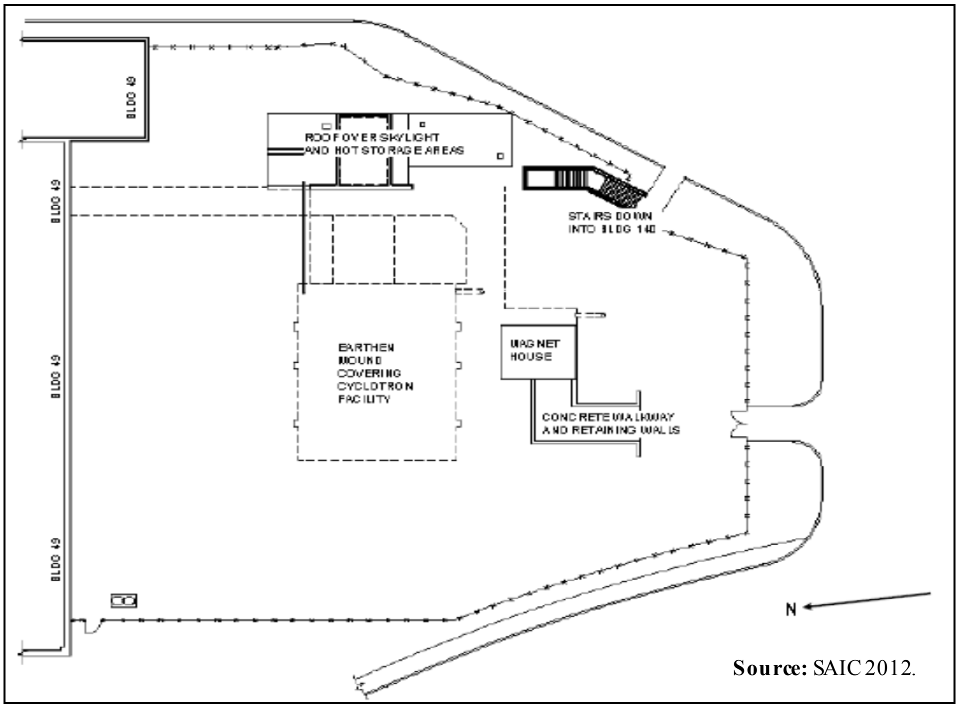


Figure 2–2. Above-Grade Diagram of Building 140

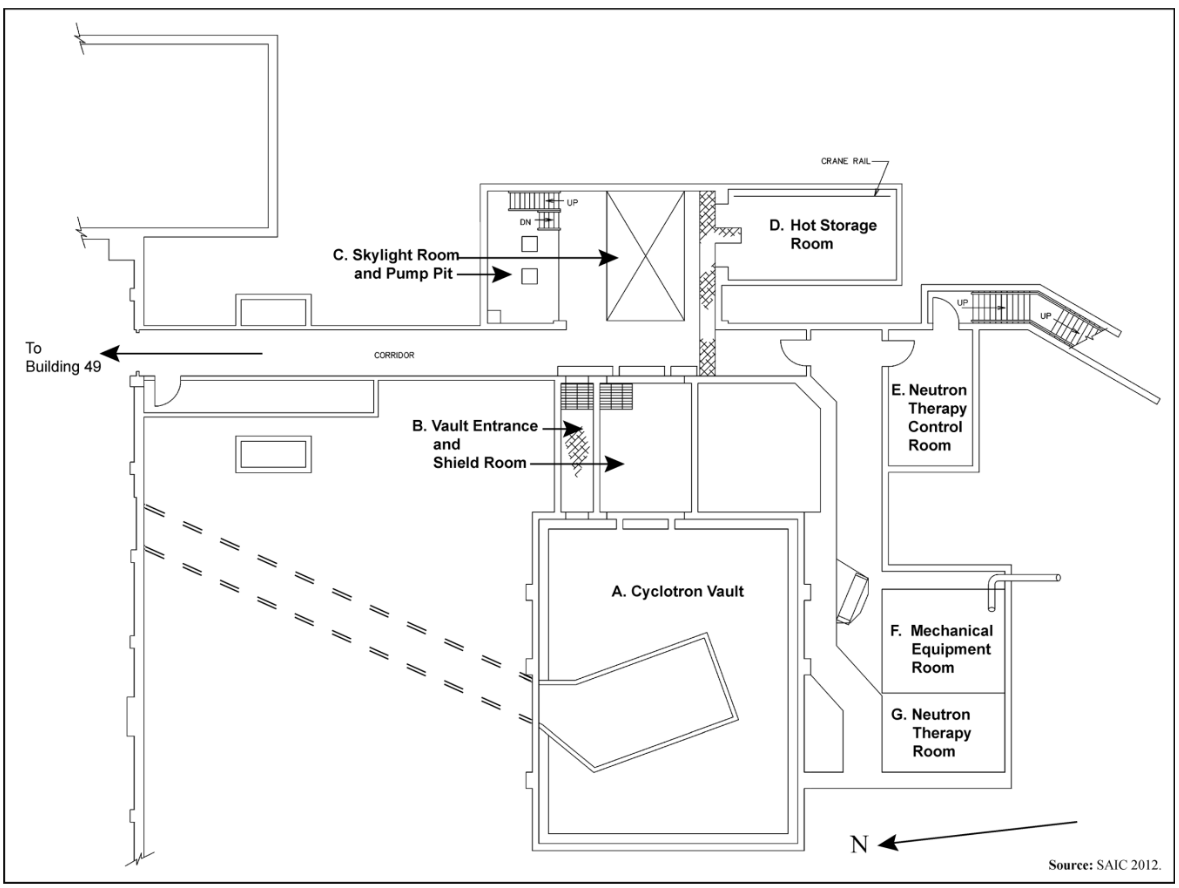


Figure 2–3. Below-Grade Diagram of Building 140

The main functional areas of Building 140 are described below and labeled in Figure 2–3. The photographs reflect the general state of the rooms as they exist today, after limited equipment removal took place in 1991. As seen in the photographs, the cyclotron machine and a large portion of the ancillary equipment was left in place to allow decay-in-storage of radioactively contaminated components.

A. Cyclotron Vault – The Cyclotron Vault houses the 175-centimeter (69-inch) particle accelerator, beam tubes, an overhead 9.1-metric-ton (10-ton) double girder manual crane, electrical panels, pumps, motors, cable trays, and an upgraded electrical heating system. The room is constructed of reinforced concrete walls, floor, and ceiling. Floor dimensions are 12.2 by 15.2 meters (40 by 50 feet) with a ceiling height of approximately 6.0 meters (19.5 feet). A service trench approximately 1.2 meters wide by 0.6 meters deep (4 feet wide by 2 feet deep) runs from the Cyclotron Vault to Building 49 and contains a conduit for cables. The room can be accessed either through the Vault Entrance or Shield Room. Large equipment can be moved in or out of the vault through the Shield Room watertight doors.

Source: SAIC 2012.

B. Vault Entrance and Shield Room – The Vault Entrance and Shield Room provide access to the cyclotron machine for equipment and personnel. The Vault Entrance is a narrow personnel entryway. Floor dimensions are 1.5 by 6.1 meters (5 by 20 feet) with a ceiling height of approximately 2.4 meters (8 feet). The Shield Room floor dimensions are 4.3 by 6.1 meters (14 by 20 feet) with a ceiling height of 6.1 meters (20 feet). Two large doors provide access to the vault and allow large equipment to be moved in or out of the Cyclotron Vault for maintenance. The Vault Entrance and Shield Room are watertight and can be flooded during particle accelerator operation to provide radiation shielding.

Source: SAIC 2012.

C. Skylight Room and Pump Pit – The Skylight Room houses the circuit breakers for Building 140, various cable trays, an overhead hoist, building ductwork, a stainless steel sink, and a pumping system for the Shield Room and Vault Entrance. Most of the pumping system has been dismantled and removed from the pit area. Floor dimensions are 10.7 by 8.5 meters (35 by 28 feet) with a ceiling height of 6.1 meters (20 feet). A 3.7-by-6.1-meter (12-by-20-foot) removable roof cover allowed for large components to be lowered into or removed from the facility.

Source: SAIC 2012.

D. Hot Storage Room – The Hot Storage Room contains 12 caves built into the wall that were once used to store high-radiation target materials. The iconel linings of the caves have been removed, surveyed and dispositioned as either scrap or low-level radioactive waste. Each cave had a separate steel-jacketed lead door that could be raised by means of an electric winch to provide access to the storage cavity. The room also contained a beam splitter that could be connected to the cyclotron through a series of removable beam tube sections. The cave doors and beam splitter have been removed from the room. Floor dimensions are 4.3 by 6.1 meters (14 by 20 feet) with a ceiling height of 6.1 meters (20 feet).

Source: SAIC 2012.

E. Neutron Therapy Control Room – The Neutron Therapy Control Room housed control equipment necessary to conduct patient therapy operations. The room is generally free of cyclotron equipment except for a sump, cabinets, and a heating system. A stairway located to the east leads to grade level outside the building and a connecting corridor provides a walkway from the Control Room to the Neutron Therapy Room. Floor dimensions for the Neutron Therapy Control Room are 4.3 by 6.1 meters (14 by 20 feet) with a ceiling height of approximately 2.4 meters (8 feet).

Source: SAIC 2012.

F. Mechanical Equipment Room – The Mechanical Equipment Room was added as part of the Neutron Therapy Room modification to house the beam tubes and steering magnets for the vertical collimator. Floor dimensions for the Mechanical Equipment Room are 4.3 by 5.5 meters (14 by 18 feet). The room is directly above the Neutron Therapy Room and is accessed by a concrete driveway from outside the facility.

Source: SAIC 2012.

G. Neutron Therapy Room – The Neutron Therapy Room was originally added to the Cyclotron Facility in 1956 as an additional target area. In 1975, the room was converted to a neutron therapy facility for the treatment of cancer patients. A series of beam tubes and steering magnets provided a vertical and horizontal collimator to accommodate the various treatment requirements. Two beam tubes run through the south wall of the Cyclotron Vault into the Neutron Therapy Room. One of the beam tubes penetrates through the ceiling and runs to the Mechanical Equipment Room. Floor dimensions are 8.8 by 7.3 meters (29 by 24 feet) with a ceiling height of approximately 3.4 meters (11 feet).

Source: SAIC 2012.

2.2 DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVE

2.2.1 Cyclotron Removal with Decontamination, Decommissioning and Demolition (Proposed Action)

As discussed in Chapter 1, NASA is proposing to decontaminate and decommission the Cyclotron Facility. The desired objectives are as follows:

- Amend GRC's U.S. Nuclear Regulatory Commission (NRC) license by decommissioning the Cyclotron Facility in accordance with NRC regulation as discussed in Chapter 1, Section 1.3.
- Reduce the overall burden of surveillance, maintenance, and monitoring costs associated with the Cyclotron Facility.
- Reduce NASA's inventory of surplus facilities.

The Proposed Action involves the removal of the cyclotron machine and ancillary equipment and support systems and byproduct materials, including both loose and fixed contamination, to a level that permits release of the site for unrestricted use, followed by the demolition of Building 140. **Figure 2–4** illustrates the project area boundary including the building structures and equipment that will be impacted by the Proposed Action. Radiological surveys will be performed to confirm that end point criteria have been met. NASA will submit an application to NRC for license amendment to remove the facility from license controls. The criteria used to determine the final site release are described in "Radiological criteria for unrestricted use" (10 CFR 20.1402), which states, "A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE [total effective dose equivalent] to an average member of the critical group that does not exceed 25 mrem [millirem] (0.25 mSv [millisieverts]) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)." The Proposed Action will not be implemented until a final EA has been issued and either a Finding of No Significant Impact has been made or NASA completes the National Environmental Policy Act (NEPA) process by preparing an environmental impact statement.

In general, the decontamination and decommissioning of the Cyclotron Facility would be accomplished in several steps: (1) Interference Equipment Removal, (2) Cyclotron Machine Removal, (3) Concrete and Soil Removal, and (4) Final Status Survey (FSS).

<u>Interference Equipment Removal</u> - All non-essential equipment and materials from Building 140 including piping, conduits, electrical systems, beam tubes, steering magnets, beam targets, and instrumentation, except for the cyclotron machine itself, would be recycled to the maximum extent practical or removed and packaged for appropriate offsite disposal.

<u>Cyclotron Machine Removal</u> - The cyclotron machine would be disassembled and removed from the building, and then would be packaged and transported to a licensed radioactive waste disposal facility in accordance with "Shippers: General Requirements for Shipments and Packaging" (49 CFR Part 173).

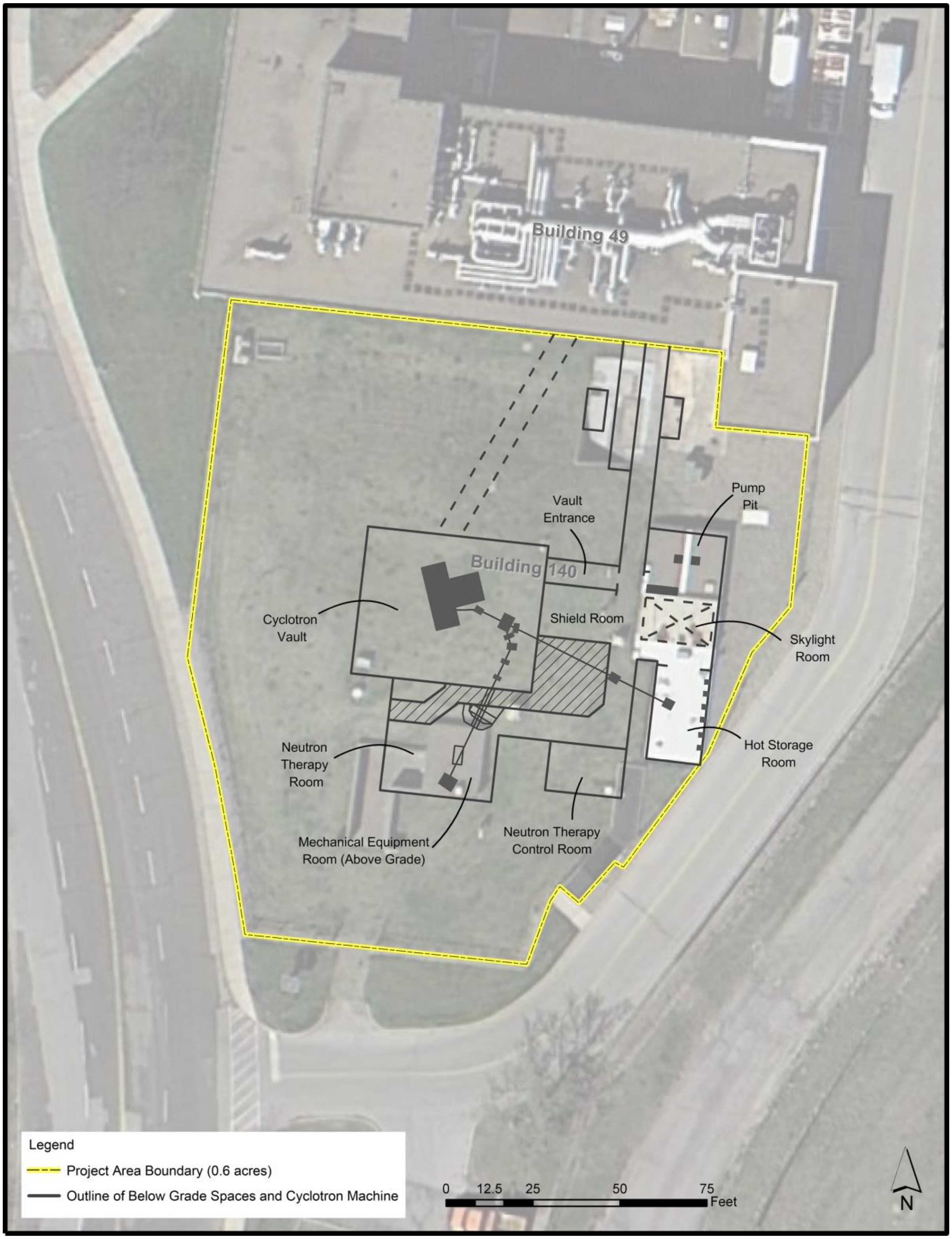


Figure 2–4. Cyclotron Removal with Decontamination, Decommissioning and Demolition

Concrete and Soil Removal - All remaining structural materials (i.e., concrete walls, footings, floors, and ceilings) and exterior piping and structures would be demolished. Structural materials associated with the Cyclotron Vault are assumed to be radioactively contaminated and would be packaged in appropriate shipping containers and transported to a licensed radioactive waste disposal facility. Any potentially contaminated soil would also be packaged and transported to a licensed low-level radioactive waste disposal facility.

Final Status Survey - An FSS report would be prepared and submitted to the NRC for review and approval. The FSS report would be used to demonstrate that the site meets the radiological criteria for unrestricted use and the project would conclude with the amendment of the current GRC NRC license and removal of the Cyclotron Facility from license control.

The property would be backfilled to its original grade and landscaped. The facility would be removed from NASA's surplus inventory, no longer requiring resources to maintain. All of the objectives would be met under the Proposed Action.

2.2.2 No Action Alternative

Under the No Action Alternative, Building 140 would remain in place and no decontamination or decommissioning would occur. This course of action would require that GRC amend its NRC license requesting that no decommissioning of the Cyclotron Facility be performed, contrary to NRC regulations. However, it is unlikely that the NRC would approve an amendment request to not decommission the Cyclotron Facility. Long-term surveillance and maintenance would continue indefinitely and minimal services would be provided to the facility, as required. The facility would be secured and access restricted. The property would remain in NASA's surplus facility inventory. None of the objectives would be met under this alternative.

This page left intentionally blank.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment and potential environmental and human health impacts associated with implementation of the Proposed Action considered in this *Environmental Assessment for the Decontamination and Decommissioning of Building 140 at GRC Lewis Field (Cyclotron EA)* and the No Action Alternative. As presented in Chapter 1, the National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC) proposes to complete the decontamination and decommissioning of Building 140, known as the Cyclotron Facility. A detailed description of the Proposed Action is provided in Chapter 2, Section 2.2, and a summary of the project's environmental impacts is presented in Section 3.14 of this chapter. Environmental impacts are discussed in this chapter for the following resource areas: land use, visual resources, geology and soils, air quality, noise, water resources, ecological resources, cultural resources, waste management, transportation, health and safety, utilities infrastructure, socioeconomics, and environmental justice. These resource areas were analyzed in a manner commensurate with their importance or the relative expected level of impact using the sliding-scale assessment approach. The general impact assessment methodology used to evaluate each resource area, and mitigation and monitoring, as applicable, are also discussed in this chapter.

3.1 LAND USE

3.1.1 Affected Environment

Lewis Field encompasses approximately 124 hectares (307 acres) of land and contains over 180 buildings, structures, and other facilities that support NASA's wide array of research, technology, and development programs. Most of Lewis Field is considered fully developed with offices, test facilities, and support facilities; however, approximately 69 hectares (170 acres) of Lewis Field are considered undeveloped (NASA 2013a).

The Cyclotron Facility is located at the NASA GRC at Lewis Field. The facility is located in Building 140, which is predominantly below-grade and interconnects at the basement level with the south end of Building 49. The two buildings are located between Wolcott Road and the northwestern edge of the Cleveland Hopkins International Airport boundary fence near the southeastern boundary of NASA property. Building 140 is made up of approximately 560 square meters (6,000 square feet) of floor space, and the project area encompasses approximately 0.3 hectares (0.7 acres) of previously disturbed land.

Adjacent to Lewis Field is Cleveland Hopkins International Airport, which operates with Class B airspace and has several runways. The airport borders Lewis Field and is generally to the southeast. Building 140 is approximately 305 meters (1,000 feet) at a perpendicular from the midway point of runway 24R-06L. The end of runway 10 is very near the main entrance to GRC Lewis Field. GRC Lewis Field lies within the inner ring of Class B airspace from the surface to 2,400 meters (8,000 feet) above mean sea level. GRC Lewis Field is connected to Cleveland Hopkins International Airport via gated taxiways. Cleveland Hopkins International Airport averages 495 operations per day and has various published precision and non-precision instrument approach procedures (FAA 2014).

3.1.2 Environmental Consequences

No changes in land use would be expected to occur under the No Action Alternative.

The Proposed Action would require the disturbance of 0.3 hectares (0.7 acres) of previously disturbed land, and result in complete removal of all man-made structures; the property would be backfilled to its original grade and landscaped. Site restoration and landscaping will incorporate, to the maximum extent practicable, plants that are beneficial to pollination and avoid using pesticides that are detrimental to pollinator habitat (White House 2014). At this time NASA has no plans to rebuild on this site, however, if any new construction is anticipated, NASA would have to evaluate the proposal to meet the requirements of the Federal Aviation Administration protection zones for Cleveland Hopkins International Airport. Impacts on adjacent onsite facilities would not be anticipated and no disturbance would be expected to occur on previously undeveloped areas.

A crane would likely be required for implementation of the Proposed Action; however, its operation is not expected to adversely impact or interfere with daily operations at Cleveland Hopkins International Airport. However, pursuant to "Safe, Efficient Use, and Preservation of the Navigable Airspace" (14 CFR Part 77), NASA would be required to file a notification of construction activity 45 days prior to erecting the crane. Notification allows the Federal Aviation Administration to identify potential aeronautical hazards in advance, thus preventing or minimizing adverse impacts on the safe and efficient use of navigable airspace. The likely outcome of such a filing would be the publication of a Notice to Airmen during the time that the crane would be operational.

3.2 VISUAL RESOURCES

3.2.1 Affected Environment

The topography near Lewis Field consists of gently rolling uplands created by glacial outwash. Lewis Field itself is generally level due to extensive cut-and-fill operations that reclaimed much of the area from steep drainage swales that once crossed the site. This overall topography contrasts sharply with the deeply eroded valleys and sloping banks of Abram Creek and Rocky River. These ravines are 15 to 30 meters (50 to 100 feet) deep, with an estimated maximum sidewall slope of 75 degrees (NASA 2013b).

Elevations in Lewis Field range from approximately 229 meters (750 feet) above sea level on the majority of the site to approximately 195 meters (640 feet) above sea level at the bottom of the Abram Creek valley. Most of this area is flat with the natural topography only slightly altered by the construction of buildings (EnviroScience 2012).

The Cyclotron Facility is predominantly below-grade. The below-grade structures are roughly 1 meter (3 feet) above the street-level-grade and are covered with soil, forming a mound 3 to 4 meters (10 to 13 feet) high at the center. Above-grade structures visible at the project area include a concrete driveway, a stairway leading below ground, various ventilation systems protruding through the top of the mound, and a chain link fence enclosing the entire area (SAIC 2012).

3.2.2 Environmental Consequences

No impacts on visual resources would occur under the No Action Alternative.

Any visual impacts during implementation of the Proposed Action would be temporary and would include increased construction activity, including the use of some heavy equipment and a crane. The Proposed Action would result in altering the land area to a level field void of structures; this would be perceived as an enhancement to visual resources at the project site. No adverse impacts on visual resources would result from the Proposed Action.

3.3 GEOLOGY AND SOILS

3.3.1 Affected Environment

In many cases, the natural soils and parent materials at Lewis Field have been removed or covered with fill, including a variety of undifferentiated soils and gravels, construction debris, and industrial and domestic waste. In the immediate vicinity at Lewis Field, bedrock is composed of the Cleveland Shale Member of the Ohio Shale. The surface is primarily covered by a thin layer (several inches to a few feet) of lacustrine clay and silt deposits that are underlain by glacial tills. Naturally occurring soils include the Mahoning Association, the Brecksville silt loam, the Chagrin silt loam, and Jimtown loam (NASA 2008; 2013a).

Soil samples were collected from Buildings 140 and 49, land area directly above Building 140, south of Building 49, and selected background reference areas during a survey conducted between 2010 and 2011. No cyclotron-related radioactivity was detected in the samples or during walkover surveys (SAIC 2012).

3.3.2 Environmental Consequences

Under the No Action Alternative, no decontamination or demolition would occur; therefore, potentially contaminated soil would not be removed under this alternative. Long-term surveillance and maintenance and monitoring would, however, continue indefinitely as necessary.

The Proposed Action would include the demolition of all below-grade structures. The cyclotron machine and all ancillary equipment would be removed from Building 140, and all above- and below-grade structures, including the service trench running between Buildings 49 and 140, would be demolished. Surrounding soil would be excavated 0.9 meters (1 yard) extending from the bottom and side edges of the Cyclotron Vault Room. Over-excavation (excavation beyond 0.9 meters [1 yard]) would not be necessary for other below-grade structures. The project area would be backfilled to its original grade, using approximately 3,160 cubic meters (111,000 cubic feet) of imported fill, and then landscaped. The resources necessary for the fill would consist of commonly available materials, and the necessary quantities would not be anticipated to impact regional supplies. Because disturbance of soils under the Proposed Action is not expected to extend into native soils and would remain within the extent of previous excavations for original construction of Building 140, there would be no adverse impacts on geology and soils.

Adherence to best management practices for erosion and sediment control would be implemented to mitigate impacts due to soil erosion and loss. All soil excavated would be characterized for radioactive contamination, and excavated soil exceeding U.S. Nuclear Regulatory Commission

(NRC) approved derived concentration guideline levels (DCGLs) would be segregated for disposal as radioactive waste. DCGLs would be developed in accordance with "Standards for Protection Against Radiation" (10 CFR Part 20).

3.4 AIR QUALITY

3.4.1 Affected Environment

Air quality at Lewis Field is regulated through the National Ambient Air Quality Standards (NAAQS) promulgated under the Federal Clean Air Act (CAA). **Table 3–1** identifies the criteria pollutants regulated by the CAA.

Lewis Field is classified as a major source of air emissions and operates under a Title V permit. The majority of emissions from Lewis Field result from the combustion of fuels, including natural gas, No. 2 fuel oils, and jet fuels. Other sources include air heaters, boilers, and steam generators. Cuyahoga County is designated as a nonattainment area for particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) and the 8-hour ozone standards. Cuyahoga County is also designated as a maintenance area for particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), carbon monoxide, and sulfur dioxide (NASA 2008).

Table 3–1. Summary Air Quality Standards

Criteria Pollutant	Federal[a] and State of Ohio Standards µg/m³ (ppm)	
Carbon Monoxide (CO)		
1-hour Average	40,000 (35)	Primary
8-hour Average	10,000 (9)	Primary
Lead (Pb)		
Quarterly Average	1.5	Both Primary and Secondary
Nitrogen Dioxide (NO_2)		
Annual Arithmetic Mean	100 (0.053)	Both Primary and Secondary
Ozone (O_3)		
1-hour Average	(0.12)	Both Primary and Secondary
8-hour Average (1997 standard)	(0.08)	
8-hour Average (2008 standard)	(0.075)	
Particulate Matter (PM_{10})		
24-hour Average	150	Primary
Particulate Matter ($PM_{2.5}$)		
Annual Arithmetic Mean	15	Both Primary and Secondary
24-hour Average[b]	35	
Sulfur Dioxide (SO_2)		
Annual Arithmetic Mean	80 (0.03)	Primary
24-hour Average	365 (0.14)	Primary
3-hour Average	1,300 (0.5)	Secondary

[a] Federal primary standards are levels of air quality necessary, with an adequate margin of safety, to protect the public health. Federal secondary standards are levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[b] Ohio has not adopted the newly changed 24-hour average for $PM_{2.5}$.

Key: µg/m3 = micrograms per cubic meter; ppm = parts per million.

Source: NASA 2008.

3.4.2 Environmental Consequences

Under the No Action Alternative, there would be no land disturbance or heavy equipment use. Therefore, there would be no increase in air pollutant emissions and thus, no impacts on air quality.

The environmental impacts of the Proposed Action on local and regional air quality are estimated based on the potential increases in regulated pollutant emissions relative to existing conditions and ambient air quality. According to the General Conformity Rule, impacts on air quality require further analysis if the proposed Federal action would result in an increase of a nonattainment or maintenance area's emissions inventory by 10 percent or more for one or more nonattainment pollutants, or if such emissions would exceed threshold levels for individual nonattainment pollutants or for pollutants for which the area has been redesignated as a maintenance area. The thresholds are similar, in most cases, to the definitions for major stationary sources of criteria and precursors to criteria pollutants under the CAA's New Source Review Program. The applicable threshold levels are 100 tons per year of nitrogen oxide or 50 tons per year of volatile organic compounds (VOCs) for a moderate ozone (8-hour) nonattainment area and 100 tons per year of particulate, sulfur dioxide, nitrogen oxides, VOCs, or ammonia for a moderate $PM_{2.5}$ (particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers) (annual averaging) nonattainment area as defined in "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR Part 93).

Under the Proposed Action air emissions would be from burning diesel fuel for operating heavy equipment (e.g., crane and excavators) and fugitive dust from exposure of soils during excavation. Truck emissions from the transport of waste materials are discussed in Section 3.15.4. Approximately 38,000 liters (10,000 gallons) of diesel fuel are expected to be burned on site and a maximum of 0.1 hectares (0.25 acres) of disturbed ground would be exposed at any given time. The predicted air emissions would be 0.797 tons per year, 0.103 tons per year, 0.307 tons per year, 0.001 tons per year, and 1.828 tons per year for nitrogen oxide, VOCs, carbon monoxide, sulfur oxide and PM_{10} or $PM_{2.5}$ respectively. For conservative analysis, it was assumed that all air emissions from the Proposed Action would occur within the same year.

Since Cuyahoga County is within a nonattainment area for the 8-hour ozone and $PM_{2.5}$ standards and is also designated as a maintenance area for PM_{10}, carbon monoxide, and sulfur dioxide, General Conformity Rule requirements are applicable. The conformity emissions thresholds are 100 tons per year for nitrogen oxide, carbon monoxide, sulfur oxide and PM_{10} or $PM_{2.5}$, and 50 tons per year for VOCs. The Proposed Action would generate emissions well below conformity threshold limits, and be expected to have a negligible impact on air quality in the vicinity of the project area. Any air emissions would be temporary and short-lived.

Radiological air emissions are not expected to occur. All decontamination, decommissioning, and demolition of radioactively contaminated building components would be done under controlled circumstances, as necessary, to prevent any radioactive contamination from being dispersed into the air.

Emissions from heavy construction equipment would be mitigated by maintaining the equipment and using best available control technologies to control emissions. Fugitive dust emissions would occur as a result of land disturbance by heavy equipment, causing suspension of soil particles in the air. Fugitive dust emissions would be mitigated using standard mitigation techniques, including watering and/or using surfactants to control dust emissions from exposed areas, revegetating exposed areas, watering roadways, and minimizing construction activity during dry or windy conditions. An environmental monitoring program would be established to ensure air emissions are kept to a minimum and would not negatively impact the environment. Air monitoring is one of the major components of an environmental monitoring program. If necessary, decontamination, decommissioning, and demolition activities would be conducted under containment or controlled conditions as radioactive material may become airborne during such activities.

3.5 NOISE

3.5.1 Affected Environment

Noise-induced hearing loss is caused by hazardous noise energy damaging the nerve cells of the inner ear; the hearing loss is permanent and will affect a person's ability to understand speech under everyday conditions. Standards for workplace noise were developed by the Occupational Safety and Health Administration (OSHA) under "Occupational noise exposure" (29 CFR 1910.95). OSHA's permissible noise exposure limits are as follows: 90 decibels on an A-weighted scale (dBA), as an 8-hour time weighted average (8-hour TWA), using a 5 decibel (dB) exchange rate; no exposures shall exceed the ceiling limit of 115 dBA, 15 minutes/day; impulse noise shall not exceed 140 dBA. When employees are subjected to hazardous noise exposures exceeding these limits, their noise exposure shall be controlled, reduced, or eliminated through a hierarchical combination of engineering controls, administrative controls, and hearing protection devices. Employers shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors shall be replaced as necessary.

NASA has set a more conservative noise exposure limit of 85 dBA, as an 8-hour TWA exposure using a 3 dB exchange rate. At GRC Lewis Field, hearing protection shall be provided to all employees exposed to noise equal to or exceeding 82 dBA, and employees are required to wear hearing protection in areas, or when using equipment, where noise levels are equal to or exceed 85 dBA. If single hearing protection (plugs or muffs) cannot reduce employee exposure levels to less than 85 dBA, as an 8-hour TWA, then double hearing protection (plugs and muffs) shall be used. Double hearing protection is recommended for sound levels exceeding 100 dBA. The workers' allowable exposure limit with the use of hearing protection is restricted to 85 dBA, as an 8-hour TWA. Should employee exposures exceed this limit engineering or administrative controls shall be implemented to restrict employee time spent in the hazardous noise (NASA 2008).

Noise generated at GRC Lewis Field is from research operations (wind tunnels and engine test cells) and transient noises such as valve releases, aircraft, construction activities, and traffic. The Central Process air system can generate high noise levels from its compressors, exhausters, heaters, chillers, and other equipment. Recent surveys indicate that, with the exception of transient noise spikes, the highest onsite noise levels measured near operating systems are in the 90–95 dBA range, with a maximum of 102 dBA. Transient peaks in noise levels may occur due to the action of relief valves, vent noise, etc. Aircraft operations can generate maximum environmental noise levels between 80 and 90 dBA in nearby pedestrian areas at Lewis Field. Onsite construction generates machinery and vehicular traffic noise (NASA 2008).

3.5.2 Environmental Consequences

Under the No Action Alternative, no decontamination, decommissioning, or demolition would occur; therefore, no potential noise impacts would occur.

Intermittent, short-term, adverse impacts from noise would be expected from implementing the Proposed Action. Noise sources would include heavy equipment (i.e., trucks, excavators, and cranes) and hand tools (i.e., drills and cutting saws). Predicted noise levels at a distance of 15 meters (50 feet) from Building 140 would be approximately 80–85 dBA for heavy equipment and 85–90 dBA for cutting saws (FHWA 2006). Hand tools such as cutting saws or drills would be predominantly used in below-grade spaces, closed off from open spaces where noise could travel outside of the project area; however, personnel inside Building 140 would potentially be exposed to noise levels that would require the use of hearing protection in accordance with NASA policy. Excavation using heavy equipment would occur, however, crane use would be very limited.

The nearest offsite receptor, a commercial office building, is located approximately 300 meters (1,000 feet) southwest of Building 140. Noise levels from any equipment associated with the decontamination, decommissioning, and demolition of Building 140 would be expected to attenuate to below 60 dBA, which is the typical sound level of an urban residential area. At these levels, noise might be perceptible to offsite receptors, but would be unlikely to have any notable impact. Noise would probably be noticeable in the immediate vicinity of the project site on GRC Lewis Field, but would generally blend in with other noise sources from Cleveland Hopkins International Airport and within GRC Lewis Field. Noise impacts would be expected to be limited to Building 140 project workers and those GRC Lewis Field employees located within adjacent Building 49. Noise would be intermittent and transitory and would cease at the completion of the project. Restricting decommissioning activities on weekends and holidays and maintaining normal working hours during weekdays would serve to further minimize potential adverse noise impacts associated with these activities.

3.6 WATER RESOURCES

3.6.1 Affected Environment

3.6.1.1 Surface Water

Lewis Field is located in the Rocky River drainage basin, which drains approximately 756 square kilometers (292 square miles) of northeastern Ohio, and ultimately discharges 8 kilometers (5 miles) to the north, into Lake Erie. In 2012, 16 streams, totaling 2,327 linear meters (7,636 linear feet), and a 0.22-hectare (0.54-acre) palustrine open water body were identified and delineated at Lewis Field (EnviroScience 2012). The primary features at the site are the Rocky River and its tributary, Abram Creek.

The majority of surface water runoff from Lewis Field flows through the storm sewer system and natural swales to Abram Creek and Rocky River. Precipitation is believed to predominantly flow overland; however, several low-volume seeps have been observed on the Abram Creek valley walls after periods of heavy rainfall (NASA 2008; 2013a). Stormwater discharges are regulated under two separate Ohio Environmental Protection Agency National Pollutant Discharge Elimination System permits. The stormwater permits require NASA GRC to implement a stormwater management program to prevent stormwater pollution from discharging to Abram Creek and Rocky River (NASA 2008).

Wastewater at Lewis Field is made up of sanitary, stormwater, non-contact and contact cooling water, cooling tower blowdown, and miscellaneous process discharges. There are three wastewater collection systems at Lewis Field: sanitary, stormwater, and industrial. The sanitary sewer system discharges by permit to the Southerly Wastewater Treatment Plant of the Northeast Ohio Regional Sewer District (NASA 2008).

Floodplains at Lewis Field occur at Abram Creek. Though Abram Creek fulfills the criteria for an area of special flood hazard, which is defined as an area of land that would be inundated by a flood having a 1 percent chance of occurring in any given year, no facilities at Lewis Field are within the 100-year floodplain (NASA 2008; 2013a).

3.6.1.2 Groundwater

Groundwater is rarely used in the vicinity of Lewis Field. Consequently, less information is available for groundwater than surface water. Groundwater at Lewis Field occurs in two distinct lithologic zones: in the shale bedrock and in perched lenses in the overlying unconsolidated materials. No aquifer at Lewis Field has been designated as a sole or principal drinking water source under the Safe Drinking Water Act, nor are there any underground injection wells at Lewis Field. A Phase I Remedial Investigation Feasibility Study found no evidence of groundwater contamination at Lewis Field (NASA 2008, 2013a).

3.6.1.3 Wetlands

In 2012, wetlands were formally delineated at Lewis Field, and the palustrine system was the only type of wetland system identified. A palustrine system is defined as "including all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean driven-derived salts is below 0.5 percent" (EnviroScience 2012). Following the formal wetland delineation, a total of 17 wetlands accounting for 0.87 hectares (2.15 acres) were affirmed by the U.S. Army Corps of Engineers. The wetlands were composed of Palustrine Emergent, Palustrine Emergent/Scrub-Shrub, and Palustrine Forested communities (EnviroScience 2012). There are currently no activities located in wetlands at Lewis Field. Ohio has developed a Coastal Zone Management Plan, which has received Federal approval. Lewis Field is not located in the Ohio Coastal Zone (NASA 2008, 2013a).

3.6.2 Environmental Consequences

Under the No Action Alternative, no decontamination, decommissioning, or demolition would occur; therefore, there would be no potential adverse impacts on water resources.

Under the Proposed Action, no adverse impacts on floodplains, wetlands, or the coastal zone are anticipated. The Cyclotron Facility (Building 140) is not located within any of the floodplains or wetlands at Lewis Field, nor is the facility situated in the coastal zone (EnviroScience 2012). Fugitive dust control using water suppression may be performed under the Proposed Action, and could contribute to runoff to the existing stormwater system. Similarly, precipitation during open excavation may lead to pooling surface water or stormwater runoff.

Best management practices for erosion and sediment control would be implemented during excavation to mitigate potential adverse impacts from exposed soils to surface water runoff. Additionally, proper emergency response plans and deployment of equipment to promptly contain and clean up accidental spills from motorized equipment would be put into place to mitigate adverse impacts on groundwater and surface water quality.

An environmental monitoring program would be established to ensure that water resources in the vicinity of the project site are not adversely impacted. Groundwater monitoring would include routine sampling of Building 140 sumps and potentially could include the installation and monitoring of wells downgradient of the site. Surface water sampling would be performed, as necessary, during soil excavations in areas prone to surface water runoff. Measurements of gross alpha and gross beta radioactivity may be used as a screening technique, or if required, specific radionuclide analysis may also be performed.

3.7 ECOLOGICAL RESOURCES

3.7.1 Affected Environment

3.7.1.1 Flora

Most of Lewis Field is too highly disturbed to support significant numbers of indigenous Ohio plant species. Approximately 69 hectares (170 acres) at Lewis Field are considered undeveloped. The gorge of Abram Creek and the tops of the bluffs above the valley are the only areas that retain natural qualities similar to their original types. The extensive development of Lewis Field as a research facility has limited the extent and recovery of natural plant communities. These communities contain few rare species. The Abram Creek gorge and adjacent bluff tops contain the most significant natural plant communities (NASA 2013a).

In a recent survey, Lewis Field upland areas were found to include new fields, old fields, and forested areas. Common plants found in new field areas were bluegrasses (*Poa* spp.), meadow fescue (*Festuca pratensis*), Canada thistle (*Cirsium arvense*), and wild carrot (*Daucus carota*). Old field areas contained similar herbaceous species but were also found to have low amounts of gray dogwood (*Cornus racemosa*), Tartarian honeysuckle (*Lonicera tatarica*), box elder (*Acer negundo*), and American elm (*Ulmus americana*). The majority of forested areas consist of American beech (*Fagus grandifolia*), white oak (*Quercus alba*), red oak (*Quercus rubra*), red maple (*Acer rubrum*), shagbark hickory (*Carya ovata*), fibrousroot sedge (*Carex communis*), yellow trout lily (*Erythronium rostratum*), bloodroot (*Sanguinaria canadensis*), cutleaf toothwort (*Cardamine concatenata*), Mayapple (*Podophyllum peltatum*) and Canadian hemlock (*Tsuga canadensis*) (EnviroScience 2012; NASA 2013a).

Wetland areas onsite contained emergent, scrub-shrub, and forested plant communities, or a combination of these. Dominant plants within the emergent wetlands surveyed at Lewis Field are soft rush (*Juncus effusus*), narrow-leaf cattail (*Typha angustifolia*), stalk-grain sedge (*Carex stipata*), fox sedge (*Carex vulpinoidea*), Torrey's rush (*Juncus torreyi*), and fowl manna grass (*Glyceria striata*). The scrub-shrub wetlands were found to contain soft rush, woolgrass (*Scirpus cyperinus*), fox sedge, Torrey's rush, fowl manna grass, northern arrowwood (*Viburnum* *dentatum*), and red osier dogwood (*Cornus alba*). Dominant plants within the forested wetlands of Lewis Field included swamp white oak (*Quercus bicolor*), box elder, red maple, pin oak (*Quercus palustris*), cottonwood (*Populus deltoides*), American elm, gray dogwood, red osier dogwood, spicebush (*Lindera benzoin*), creeping Jenny (*Lysimachia nummularia*), stalk-grain sedge, fox sedge, fowl manna grass, and drooping sedge (*Carex prasina*) (EnviroScience 2012; NASA 2013a).

The Ohio Department of Natural Resources Natural Heritage Database lists 6 endangered, 14 threatened, and 20 potentially threatened plants species that have the potential to be found in Cuyahoga County (ODNR 2012). None of the current federally or state-listed plant species for Cuyahoga County have been identified on Lewis Field.

3.7.1.2 Fauna

Animals that inhabit Lewis Field are those typical of urban areas, including squirrels, chipmunks, rabbits, deer, and groundhogs. Previous surveys have identified common birds that inhabit Lewis Field including the European starling, house sparrow, American robin, chimney swift, and house finch. The "wooded, successional, and grassland habitats" in this area were judged to be too small and fragmented to support other species of birds. A few amphibian species, one reptile, many species of butterflies and moths, and three common bat species have also been identified at Lewis Field (NASA 2013a).

The Ohio Department of Natural Resources Natural Heritage Database lists four endangered and four threatened animal species that have the potential to be found in Cuyahoga County (ODNR 2012). Additionally, Cuyahoga County is within the known ranges of three federally listed endangered species, one threatened species, and one proposed endangered species (USFWS 2014). None of the current federally or state-listed animal species have been encountered on Lewis Field.

3.7.2 Environmental Consequences

No current federally or state-listed threatened or endangered plant or animal species have been known to occur at Lewis Field and the Cyclotron Facility lies within a highly developed area of Lewis Field; therefore no adverse direct or indirect impacts to ecological resources would occur under the No Action Alternative or from implementation of the Proposed Action. Site restoration and landscaping will incorporate, to the maximum extent practicable, plants that are beneficial to pollination and avoid using pesticides that are detrimental to pollinator habitat. Taking these measures will help to reverse pollinator losses and help restore populations to healthy levels (White House 2014).

3.8 CULTURAL RESOURCES

3.8.1 Affected Environment

Federal agencies are required to protect and preserve cultural resources in cooperation with state and local government under the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) (16 U.S.C. 470 et seq.). Cultural resources are any prehistoric or historic building, structure, object, site, or district considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include architectural resources, archaeological resources, and traditional resources. Architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community (NASA 2008).

3.8.1.1 Architectural Resources

A number of Federal laws, regulations, and guidelines have been established for the management of cultural resources. Regulations include Section 106 of the NHPA, as amended, which requires Federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are cultural resources that are listed in, or eligible for listing in, the National Register of Historic Places (NRHP). Eligibility evaluation is the process by which resources are assessed relative to NRHP significance criteria for scientific or historic research, for the general public, and for traditional cultural groups.

NASA has been inventorying and identifying resources eligible for listing in the NRHP at Lewis Field since the 1990s (OHI 1996). Two Lewis Field facilities were designated as National Historic Landmarks (NHLs) under the "Man in Space" theme (Butowsky 1984). One NHL, the Rocket Engine Test Facility, was demolished in 2003 to accommodate an airport runway expansion. The other NHL, the Microgravity Research Laboratory (Zero Gravity Facility, Building 110), remains at Lewis Field (Gray & Pape 2008).

In 2007, NASA completed a survey of test facilities nationwide to determine their relative historical significance in terms of contributions to the development of the space transportation system. Two facilities at NASA GRC, the 8 × 6 Supersonic Wind Tunnel and the Abe Silverstein Memorial Wind Tunnel (the 10 × 10 Supersonic Wind Tunnel), are considered eligible for listing on the NRHP (NASA 2008).

Over the past decade, NASA GRC has continued its effort to identify and evaluate additional historic architectural resources at Lewis Field. Surveys were conducted in 2000, 2002, and 2013. The surveys identified an NRHP-eligible historic district in the GRC Lewis Field Central Area (Gray & Pape 2008; mbi/k2m and Westlake 2013). The district encompasses buildings and structures that supported initial missions under the National Advisory Committee for Aeronautics through the reorganization to NASA (1942 to 1958), and the Apollo Era mission ending in 1965, or that have distinctive architectural or construction features (NASA 2008).

3.8.1.2 Archaeological Resources

While detailed archaeological surveys do not exist for the entirety of Lewis Field, a 1998 Gray & Pape cultural resources survey of Lewis Field created an archaeological resource predictive model and resulted in a cultural resources sensitivity map. The portion of Lewis Field that includes the Cyclotron Facility is considered to have a low potential for the presence of intact archaeological resources because of the extent of disturbance from construction and utility installation (Gray & Pape 2008).

Several archaeological surveys have been conducted at Lewis Field in 1998 and 2002 in conjunction with proposed Cleveland Hopkins International Airport expansions. The surveys indicate that no significant or potentially significant archaeological sites are located at Lewis Field (FAA 2000; NASA 2008; Parsons 2000).

3.8.1.3 Traditional Cultural Resources

Traditional cultural resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Traditional cultural resources have not been identified at Lewis Field.

3.8.2 Environmental Consequences

Under the No Action Alternative, no portion of the Cyclotron Facility would be removed; therefore, impacts on cultural resources would not occur. NASA would continue to manage its cultural resources in compliance with Federal laws and regulations, guided by the GRC Cultural Resources Management Plan (Gray & Pape 2008).

Although the Cyclotron Facility lies within the boundaries of the proposed historic district, it does not meet the criteria for inclusion in the historic district as a contributing element, nor does NASA consider the Cyclotron Facility to be individually eligible for listing on the NRHP. Therefore, NASA determined that the Cyclotron Facility (Building 140) and the equipment it houses (including the cyclotron itself) are not eligible for listing on the NRHP. NASA initiated NHPA Section 106 consultation with the Ohio Historic Preservation Office (OHPO) on August 30, 2013 (NASA 2013b). The OHPO has not commented on the determination of eligibility or on the request for consultation.

Because of its low profile (the majority of the Cyclotron Facility lies below grade) and its position at the southeast edge of the historic district, removal of this facility would not have an adverse visual effect on any historic property within the district.

There are no known archaeological sites within the area of potential effects, and it is extremely unlikely that undisturbed archaeological resources remain within the area of potential effects. Therefore, the Proposed Action would have no effect on archaeological historic properties.

The Proposed Action would not excavate soils that have not been previously disturbed. In the event that archaeological resources are unexpectedly discovered while demolishing the concrete vault, procedures are in place at Lewis Field to properly manage the discovery site, as outlined in the GRC Cultural Resources Management Plan's "Protocol for Unanticipated Discovery of Archeological Materials" (Gray & Pape 2008). In the extremely unlikely event that human remains are encountered while implementing the Proposed Action, the procedures outlined in the GRC Cultural Resources Management Plan's "Protocol for Treatment of Human Remains" will be implemented (Gray & Pape 2008).

3.9 WASTE MANAGEMENT

3.9.1 Affected Environment

As part of ongoing activities, GRC Lewis Field receives and stores various quantities of hazardous materials. GRC Lewis Field is a Large Quantity Hazardous Waste Generator, which is defined as a site that generates more than 1,000 kilograms (2,200 pounds) of hazardous waste or more than 1.0 kilogram (2.2 pounds) of acute hazardous waste per calendar month. All hazardous materials and hazardous waste are managed in accordance with applicable Federal, state, and local rules and regulations in accordance with the NASA GRC Environmental Programs Manual. The Environmental Programs Manual contains detailed policies and procedures related to the management of hazardous materials and hazardous waste (NASA 2008).

At GRC Lewis Field, oversight and guidance for the handling, storage, and disposal of hazardous waste are provided by the GRC Energy and Environmental Office. Hazardous materials and waste are transferred to Building 215, the Central Chemical Storage Facility, for temporary storage (90-day maximum for hazardous waste) while a means of reuse, recycling or disposal is determined. Once the determination is made, the Energy and Environmental Office arranges for a waste disposal contractor to pick up and deliver the hazardous waste to an appropriate offsite disposal facility (NASA 2008). GRC Lewis Field does not maintain long-term, onsite storage capabilities for waste. On a case-by-case basis, some projects may require a custom waste management plan developed by the Energy and Environmental Office.

3.9.2 Environmental Consequences

Under the No Action Alternative, decontamination, decommissioning, and demolition activities would not occur. Therefore, there would be no waste management impacts under the No Action Alternative.

Under the Proposed Action, various waste streams would be generated during decontamination, decommissioning, and demolition activities. These may include nonhazardous, nonhazardous but otherwise regulated, hazardous, and low-level radioactive waste (LLW).

Any nonhazardous solid waste generated during decontamination, decommissioning, and demolition of Building 140 would be packaged and transported in conformance with standard industrial practices. Solid waste, such as uncontaminated metal items that can be recycled, would be sent off site for that purpose. The remaining debris derived from demolition of uncontaminated structures would be packaged in roll-off containers for transport to an offsite permitted commercial or municipal disposal facility in accordance with applicable regulations.

Regulated waste would be packaged in U.S. Department of Transportation- (DOT-) approved containers in a manner appropriate to the specific waste type, and shipped off site to permitted commercial recycling, treatment, and disposal facilities. Regulated waste would be shipped off site as it is generated from decontamination, decommissioning, and demolition activities. Therefore, long-term waste storage facilities would not be required. Regulated waste associated with Building 140 would include building materials containing asbestos, equipment containing mercury, equipment containing polychlorinated biphenyls, and building components that have lead-based paint. Building materials containing friable asbestos would be required to be abated prior to building demolition. Building components such as thermostats, switches, and fluorescent lights that contain mercury and light ballasts that contain polychlorinated biphenyls would be segregated from other waste for shipment off site to an appropriate disposal and/or recycling facility. Components with lead-based paint would also need to be characterized prior to disposal in accordance with Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901 et seq.) regulations for determining whether the waste should be considered a hazardous waste.

LLW would be packaged in roll-on/roll-off containers, lift liners, 55-gallon drums, B-25 boxes, or similar containers, depending on the waste classification and type. If necessary, shielded casks may also be used for components characterized with higher levels of radioactivity. Drums and B-25 boxes would primarily be used to package LLW consisting of removed interferences, smaller system components and equipment, piping, conduit, and dry activated waste (e.g., personal protective equipment, contaminated monitoring and cleanup supplies, radiologically impacted samples, etc.) Roll-on/roll-off type containers would primarily be used for concrete debris. Large cyclotron components may be placed in similar containers or possibly palletized for transport on a flat-bed trailer. Lift liners or lined roll-ons/roll-offs would primarily be used to package contaminated soil for disposal.

For purposes of analysis in this *Cyclotron EA*, all waste generated from decontamination, decommissioning, and demolition of Building 140 is assumed to be Class A LLW as defined by the NRC in accordance with "Licensing Requirements for Land Disposal of Radioactive Waste" (10 CFR Part 61) and would be shipped to an appropriate LLW waste disposal facility. Under the Proposed Action, the entire subgrade structure of Building 140 would be demolished. Up to approximately 2,200 cubic meters (78,000 cubic feet) of LLW could be generated under the Proposed Action.

Only a few commercial LLW disposal facilities exist in the United States. LLW from Building 140 would go to one of two Energy*Solutions*, Inc. facilities located in Bear Creek, Tennessee or Clive, Utah. However, it is anticipated that a large portion of the estimated volume of waste generated would not be radioactively contaminated but considered solid waste and disposed in accordance with the RCRA requirements.

Waste management includes provisions for minimizing the amount of waste generated, as well as for waste collection, treatment, packaging, and shipment off site for processing and disposal. The most effective radioactive waste disposal strategies and mitigation measures would include (1) performing sampling and analysis activities to accurately define the range of contamination and further reduce the quantity of specific waste streams; (2) reusing materials in radioactively contaminated areas to minimize waste generation; (3) performing onsite decontamination when shown to be cost-effective if doing so would not generate significant quantities of secondary waste; and (4) performing volume reduction techniques, where practical, by crushing and cutting components and equipment to size to eliminate void spaces in the waste packages.

3.10 TRANSPORTATION

3.10.1 Affected Environment

Lewis Field is served by a transportation system that connects it to local, regional, and national points. Interstate Highways 480 and 71 are located within 1.6 kilometers (1.0 mile) and connect Lewis Field regionally and nationally. Cleveland Hopkins International Airport is located adjacent to Lewis Field and provides easy access to numerous daily commercial flights. Cleveland's network of freeways and local roadways provides quick access to residential areas and business clusters located throughout the metropolitan area. The onsite transportation system at Lewis Field provides quick, convenient circulation to all points within Lewis Field (NASA 2008).

Two primary vehicle access points serve GRC Lewis Field. The vehicle access points include the controlled security gates: Main Gate and West Gate. The majority of employees and all visitors must access the campus through the Main Gate at Brookpark Road. As currently configured, there are two ingress lanes and two egress lanes, and the current configuration requires truck and automobile traffic to pass through the same gate (NASA 2008).

The principal arterial road providing access to the main entrance of Lewis Field is Ohio State Highway 17 (Brookpark Road), which parallels Interstate 480 from Ohio State Highway 10 to Interstate 71 along the northern limits of the campus. Brookpark Road carries two lanes of traffic in each direction with a total average daily traffic count of approximately 10,000 vehicles per day near the Main Gate. The primary arterial feeder to Brookpark Road is Interstate 480, which carries an average daily traffic count of approximately 129,000 vehicles. The Interstate 480 (east to west) and Interstate 71 (north to south) interchange is approximately 1.6 kilometers (1.0 mile) east of the Main Gate (NASA 2008).

3.10.2 Environmental Consequences

Under the No Action Alternative, no waste would be generated from decontamination, decommissioning, or demolition; therefore, no transportation impacts would occur.

Under the Proposed Action, transportation of waste from the site to appropriate disposal facilities would be required. Transportation accidents involving radioactive materials have the potential for both radiological and nonradiological risk to transportation workers and the public. The potential risk associated with incident-free and accident conditions for transportation routes to potential waste disposal facilities are estimated for the Proposed Action, and discussed in this section.

Risk, the primary metric for assessing transportation impacts, is expressed in terms of latent cancer fatalities (LCFs) except for nonradiological risk, where it refers to the number of traffic accident fatalities. In determining transportation risks, per-shipment risk factors were calculated for incident-free and accident conditions using the RADTRAN 6 [Radioactive Material Transportation Risk Assessment Code 6] computer program (SNL 2009), in conjunction with the TRAGIS [Transportation Routing Analysis Geographic Information System] computer program (Johnson and Michelhaugh 2003). RADTRAN 6 was used to estimate the impacts on transportation workers and members of the public. For incident-free transportation, the potential human health impacts of the radiation field surrounding the transportation packages were estimated for transportation workers and the general population along the route (off-traffic or off-link), as well as for people sharing the route (in-traffic or on-link) and at rest areas and other stops along the route. For incident-free operations, the affected population included individuals living within 0.8 kilometers (0.5 miles) of each side of the road or railroad.

The total radiological dose-risk estimate was obtained using RADTRAN and summing the individual radiological risks from all reasonably conceivable accidents for the affected population within 81 kilometers (50 miles) of the accident.

Radiological health impacts are expressed in terms of additional LCFs. Nonradiological accident impacts are expressed as additional immediate (traffic accident) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by a dose conversion factor of 0.0006 LCFs per rem or person-rem of exposure (DOE 2003). The assumptions and resulting risk estimates are presented in the subsections below.

3.10.2.1 Offsite Route Characteristics

Route characteristics that are important to the transportation impacts analysis include the total shipment distance and population distribution along the route. TRAGIS was used to map transportation routes in accordance with DOT regulations. The TRAGIS program also provided population density estimates for rural, suburban, and urban areas along transportation routes based on 2010 census data. Route-specific accident and fatality rates for commercial truck and rail transports were used to determine the risk of traffic accident fatalities (Saricks and Tompkins 1999) after adjusting for possible under-reporting in truck rates (UMTRI 2003).

Potential disposal facilities include LLW facilities in Clive, Utah, and Bear Creek, Tennessee, both operated by Energy*Solutions*, Inc. The one-way distance from GRC Lewis Field to Clive, Utah, is approximately 2,700 kilometers (1,700 miles) by truck and 3,200 kilometers (2,000 miles) by rail. The one-way distance to Bear Creek, Tennessee, is 900 kilometers (560 miles) by truck and 860 kilometers (540 miles) by rail. For purposes of analysis, it is conservatively assumed that all waste would be shipped to the Clive, Utah, facility; any potential shipments that might be diverted to the Bear Creek, Tennessee, facility would result in a decrease in exposure and accident risk due to the corresponding decrease in one-way distance traveled.

3.10.2.2 Packaging and Shipments

Shipping packages containing radioactive materials emit low levels of radiation; the amount of radiation depends on the kind and amount of transported materials. DOT regulations "Shippers: General Requirements for Shipments and Packaging" (49 CFR Part 173) require shipping packages containing radioactive materials to have sufficient radiation shielding to limit the radiation dose rate to 10 millirem per hour at a distance of 2.0 meters (6.6 feet) from the outer lateral surfaces of the transporter. Radioactive material would be released during transportation accidents only when the package carrying the material is subjected to forces that exceed the package design standard. Only a severe fire or a powerful collision, both events of extremely low probability, could damage a transportation package of the type used to transport radioactive material to the extent that radioactivity would be released to the environment with significant consequences.

Several types of containers may be used to transport radioactive materials. The various containers analyzed to transport LLW in this *Cyclotron EA* include 55-gallon drums, B-25 boxes, lift liners, roll-on/roll-offs, and, if necessary, shielded casks. However, the need to use shielded casks for this project is unlikely. **Table 3–2** lists the types of containers assumed for the analysis, along with their volumes and the number of containers in a shipment.

In this environmental assessment (EA), risk associated with shipments of radioactive waste was calculated assuming that waste would be transported using either only commercial truck or only commercial rail; risk associated with waste shipments split between the two available modes of transportation would be within the range of the calculated risk for truck and rail. A shipment is defined as the amount of waste transported on a single truck or rail car.

Table 3–2. Low-Level Radioactive Waste Container Characteristics

Container	Container Volume (cubic meters)	Shipment Description
Shielded cask (Model 14-210H)[a]	2.8	1 per truck/2 per rail car
55-gallon drum	0.2	80 per truck/160 per rail car
B-25 box	2.6	5 per truck/10 per rail car
Roll-on/roll-off	15.3	1 per truck/2 per rail car
Lift liner	7.3	2 per truck/4 per rail car

[a] The Model 14-120H Type A shielded cask is designed to accommodate up to 14, 55-gallon drums or approximately 5 cubic meters of non-drummed waste. For purposes of analysis, the maximum volume used for the cask is 14, 55-gallon drums or 2.8 cubic meters. However, the need to use shielded casks for this project is unlikely.

Note: To convert cubic meters to cubic feet, multiply by 35.315.

Source: DOE 1997; Energy*Solutions* 2014; MHF 2014; RUDCO 2014.

In general, the number of shipping containers per shipment was estimated on the basis of the dimensions and weight of the shipping containers, the Transport Index,[1] and the transport vehicle dimensions and weight limits. The various materials and waste were assumed to be transported on standard truck semi-trailers or rail cars.

The predicted number of packages requiring offsite transportation and the calculated number of truck or rail shipments is based on the volume of waste assumed to be generated under the Proposed Action (see Section 3.9.2) and the volume each container can hold (see Table 3–2), and is presented in **Table 3–3**, in the following subsection.

3.10.2.3 Risk Assessment

For transportation accidents, the risk factors are given for both radiological impacts, in terms of potential LCFs in the exposed population, and nonradiological impacts, in terms of number of traffic fatalities. LCFs represent the number of additional latent fatal cancers among the exposed population in the event of an accident. Under accident conditions, the population would be exposed to radiation from released radioactivity if the package were damaged and would receive a direct dose if the package were breached.

Per-shipment risk factors were calculated for the crew and for collective populations of exposed persons for each container type. Radiological risk factors per shipment by truck or rail for incident-free transportation and accident conditions are presented in Table 3–3. For incident-free transportation, both dose and LCF risk factors are provided for the crew and exposed population. The radiological risks would result from potential exposure of people to external radiation emanating from the packaged waste. The exposed population includes the off-link public (people living along the route), the on-link public (pedestrian and car occupants along the route), and public

[1] The Transport Index is a dimensionless number (rounded up to the next tenth), placed on the label of a package, to designate the degree of control to be exercised by the carrier. Its value is equivalent to the maximum radiation level in millirem per hour at 1 meter (3.3 feet) from the package.

at rest and fuel stops. LCF risks were calculated by multiplying the accident dose-risks by a health risk conversion factor of 0.0006 cancer fatalities per person-rem of exposure (DOE 2003).

For purposes of accident-with-release analysis, it is conservatively assumed the inventory of radioactive materials in containers would be associated with the maximum concentrations that potentially could be shipped in each container. The nonradiological risk factors are nonoccupational traffic fatalities resulting from transportation accidents.

Using the number of shipments by container type and the per-shipment risk presented in Table 3–3, total risk to crew and the general population is extrapolated for the total number of shipments projected under the Proposed Action. **Table 3–4** summarizes the predicted transportation risk considering all shipments of radioactive waste under the Proposed Action.

The highest risk due to incident-free transportation would be transport by truck, where the risk to the crew would be 2×10^{-3} LCFs and the risk to the public would be 9×10^{-4} LCFs. This risk can also be interpreted as meaning that there is a chance of approximately 1 in 500 that an additional latent fatal cancer could be experienced among the exposed workers and a chance of 1 in 1,100 that an additional latent fatal cancer could be experienced among the exposed population residing along the transport route.

The nonradiological accident risk (the potential for fatalities as a direct result of traffic accidents) is greater than the radiological accident risk. The highest risk of a nonradiological accident is 0.02 for truck shipments. For comparison, in the United States in 2010 there were over 3,900 fatalities due to crashes involving large trucks (DOT 2012a) and over 32,000 traffic fatalities due to all vehicular crashes (DOT 2012b).

Table 3–3. Risk per Shipment of Low-Level Radioactive Waste

Container	Number of Packages	Number of Shipments[b]	Incident-Free[a] Crew Dose (person-rem)	Incident-Free[a] Crew Risk (LCF)[c]	Incident-Free[a] Population Dose (person-rem)	Incident-Free[a] Population Risk (LCF)[c]	Accident Radiological Risk (LCF)[c]	Accident Non-Radiological Risk (fatalities)[c]
Truck Shipments								
Shielded cask[d]	8	8	8.0×10^{-2}	5×10^{-5}	4.6×10^{-2}	3×10^{-5}	1×10^{-14}	1×10^{-4}
55-gallon drum	311	4	3.3×10^{-2}	2×10^{-5}	2.1×10^{-2}	1×10^{-5}	8×10^{-14}	1×10^{-4}
B-25 box	133	27	2.7×10^{-2}	2×10^{-5}	1.1×10^{-2}	6×10^{-6}	6×10^{-14}	1×10^{-4}
Lift liner	61	61	3.6×10^{-2}	2×10^{-5}	1.2×10^{-2}	7×10^{-6}	8×10^{-14}	1×10^{-4}
Roll-off	114	57	3.3×10^{-3}	2×10^{-6}	8.8×10^{-4}	5×10^{-7}	4×10^{-16}	1×10^{-4}
Rail Shipments								
Shielded cask[d]	8	4	4.9×10^{-2}	3×10^{-5}	9.0×10^{-2}	5×10^{-5}	3×10^{-14}	1×10^{-4}
55-gallon drum	311	2	9.5×10^{-3}	6×10^{-6}	1.3×10^{-2}	8×10^{-6}	3×10^{-13}	1×10^{-4}
B-25 box	133	14	9.5×10^{-3}	6×10^{-6}	1.3×10^{-2}	8×10^{-6}	2×10^{-13}	1×10^{-4}
Lift liner	61	31	1.1×10^{-2}	7×10^{-6}	1.4×10^{-2}	9×10^{-6}	3×10^{-13}	1×10^{-4}
Roll-off	114	29	7.5×10^{-4}	4×10^{-7}	1.4×10^{-3}	7×10^{-7}	1×10^{-15}	1×10^{-4}

[a] Based on available characterization data for the Cyclotron Facility, it is conservatively assumed that the dose rate for shielded casks would be at the regulatory limit of 10 millirem per hour at 2.0 meters (6.6 feet); the dose rate for drums, B-25 boxes, and roll-on/roll-offs would be 1.0 millirem per hour at 1.0 meter (3.3 feet); and the dose rate for lift liners containing mostly soil would be 0.1 millirem per hour at 1.0 meter (3.3 feet).

[b] Number of shipments assumes waste would be shipped using either all truck or all rail.

[c] Risk is expressed in terms of LCF, except for the nonradiological risk, where it refers to the number of traffic accident fatalities. Radiological risk is calculated for one-way travel while nonradiological risk is calculated for two-way travel. Accident dose-risk can be calculated by dividing the risk values by 0.0006 (DOE 2003). The values are rounded to one non-zero digit.

[d] Assumes Model 14-120H Type A shielded cask. However, the need to use shielded casks for this project is unlikely.

Key: LCF=latent cancer fatality.

Table 3–4. Total Dose and Risk from Transporting Radioactive Waste

Transport Mode	One-Way Distance Traveled (km)	Number of Shipments[a]	Incident-Free Crew Dose (person-rem)	Incident-Free Crew Risk (LCF)[b]	Incident-Free Population Dose (person-rem)	Incident-Free Population Risk (LCF)[b]	Accident Radiological Risk (LCF)[b]	Accident Non-Radiological Risk (fatalities)[b]
Truck Shipments	424,000	157	3.8	2×10^{-3}	1.5	9×10^{-4}	6×10^{-12}	2×10^{-2}
Rail Shipments	255,000	80	0.69	4×10^{-4}	1.0	6×10^{-4}	1×10^{-11}	8×10^{-3}

[a] Number of shipments assumes waste would be shipped using either all truck or all rail.

[b] Risk is expressed in terms of LCF, except for the nonradiological risk, where it refers to the number of traffic accident fatalities. Radiological risk is calculated for one-way travel while nonradiological risk is calculated for two-way travel. Accident dose-risk can be calculated by dividing the risk values by 0.0006 (DOE 2003). The values are rounded to one non-zero digit.

Key: km=kilometers; LCF=latent cancer fatality.

Note: To convert kilometers to miles, multiply by 0.6214.

Based on the analysis discussed above, the risk to the crew and the general population from the maximum number of potential shipments of LLW associated with the Proposed Action would be considered negligible.

Both radiological and nonradiological impacts would result from shipment of radioactive or hazardous materials from the Cyclotron Facility to offsite disposal sites. To the extent practicable, transportation routes would be selected to minimize the impacts from potential exposure to radiation during both incident-free transport and postulated accidents, as well as to minimize the potential for traffic fatalities. Measures that could be used to mitigate radiological impacts on individuals and populations along transportation routes include scheduling the transport of materials or waste only during periods of light traffic volume. The packaging and transport of radioactive and other hazardous materials would be in compliance with the applicable NRC, DOT, and state regulations. Waste would be shipped for direct disposal using various containers such as roll-ons/roll-offs, lift liners, B-25 boxes, and 55-gallon drums. Shielded casks may also be used to reduce dose rates for certain shipments of cyclotron equipment that might contain higher concentrations of low-level radioactive waste.

Handling, staging, and shipping packaged radioactive waste will be conducted in accordance with "Transfer for disposal and manifests" (10 CFR 20.2006); "Hazardous Materials Regulations" (49 CFR Parts 171-180); "Licensing Requirements for Land Disposal of Radioactive Waste" (10 CFR Part 61); "Packaging and Transportation of Radioactive Material" (10 CFR Part 71); and the disposal or processing facility license conditions. Waste may be shipped to a licensed processing facility for disposition or may be disposed of directly at a licensed disposal facility.

3.11 HEALTH AND SAFETY

3.11.1 Affected Environment

3.11.1.1 Health and Safety Programs

A comprehensive health and safety program is in place at GRC Lewis Field, including components for radiation protection and occupational health and institutional safety. The Occupational Health Programs Manual contains detailed policies and procedures related to ionizing and non-ionizing radiation sources. GRC's Radiation Protection Program establishes the administrative requirements, technical guidelines, regulatory compliance, and health physics practices and procedures for facilities and users of ionizing and non-ionizing radiation sources and equipment. GRC has a "specific materials license of limited scope" with the NRC and is allowed to possess those radioactive sources specifically listed in that license. GRC also possesses other sources that are generally licensed by the NRC (NASA 2013a).

3.11.1.2 Annual Dose Limits for Radiation

Annual dose limits for exposure to radiation have been established for workers and the public. The annual dose limit for occupational exposures to workers is 5 rem per year pursuant to NRC regulations "Standards for Protection Against Radiation" (10 CFR Part 20). NASA has established more-stringent administrative dose limits for radiation workers at GRC to be 10 percent of the regulatory limit. Administrative limits would not be increased without specific authorization of the NASA Radiation Safety Officer. The annual dose limit for members of the public would be consistent with NRC regulations at 0.1 rem total effective dose equivalent, exclusive of the dose contributions from background radiation, medical administration, and disposal of radioactive material in sewage.

3.11.1.3 Background Radiation Levels in the Vicinity of Building 140

During the period from June 2010 through April 2011, characterization data were collected from Buildings 140 and 49, land area directly above Building 140 and south of Building 49, and selected background reference areas (SAIC 2012). The characterization report identified a list of radionuclides that can be expected to be encountered in Building 140, based on samples collected from building concrete, smears (loose-surface contamination), metals (cyclotron components), and sediment (sumps and pipe trenches). The radionuclides of interest include the following: hydrogen-3 (tritium), sodium-22, aluminum-26, cobalt-60, nickel-63, strontium-90, technetium-99, silver-108m, antimony-125, cesium-137, europium-152, europium-154, and radium-226. No radionuclides of interest were identified in water (sump) samples, and activity levels in soil samples were identified as being consistent with normal background levels. Detailed information can be found in the *Site Characterization Report, NASA GRC Cyclotron Facility* (SAIC 2012).

3.11.2 Environmental Consequences

Under the No Action Alternative, no decontamination, decommissioning, or demolition would take place. Long-term surveillance and maintenance would continue indefinitely and minimal services would be provided to the facility, as required. There would be small, but negligible, worker doses associated with those activities and industrial hazards would be minimal.

The principal health and safety impacts projected for the Proposed Action are impacts on workers at the facility performing the decontamination, decommissioning, and demolition activities. These impacts are primarily controlled, planned occupational exposures to radiation associated with the radioactively contaminated materials within the Cyclotron Facility and the potential for industrial incidents and accidents. Each of these risks to workers is controlled and managed by existing NASA programs at GRC. Because each of the projected activities is contained and controlled, no health and safety impacts on either onsite personnel or the general public are projected.

3.11.2.1 Industrial

Nonradiological hazards associated with Cyclotron Facility decontamination, decommissioning, and demolition would continue to be managed according to the NASA GRC Health Programs Manual and the NASA GRC Safety Manual or through guidance provided by a site-specific procedure. These manuals provide the safety and health requirements necessary to protect the life, health, and physical well-being of all NASA GRC employees, contractor employees, visitors, and others; to ensure the safety of the public from hazards, incidents, and/or operations from construction activities; to prevent damage to property, supplies, and equipment; and to prevent accidents that might interrupt work, thereby delaying NASA programs and/or negatively affecting NASA property. All persons engaged in construction activities must meet or exceed the minimum safety and health requirements defined in these manuals and must comply with all applicable Federal, state, and local codes and standards where required, including NASA agency and center policies and/or procedures.

No unusual industrial safety hazards to the workers would be anticipated under the Proposed Action. Collectively, the Industrial Safety Program that would be in place for the decontamination, decommissioning, and demolition activities should be adequate to minimize worker incidents and accidents.

3.11.2.2 Radiological

No radiological exposure impacts on offsite members of the public are expected; therefore this section focuses on the potential radiological impacts on workers. The estimated cumulative worker doses for each work task under the Proposed Action are presented in **Table 3–5**. These worker doses were estimated using the assumed labor hours for each task and the exposure rates measured during characterization surveys. It was assumed that all radiation doses to workers would occur through direct external exposure to ionizing radiation. The dose estimated considered only external exposure and did not include inhalation or dermal absorption pathways as these exposure pathways are expected to be minimal.

Table 3–5. Estimated Worker Dose

Task Description	Estimated Hours in Radiation Field	Estimated Dose Rate (mrem/hr)	Dose Reduction Factor[a]	Dose Rate Shielded (mrem/hr)	Person-Rem Estimate
Interference Removal, Package and Dispose of Waste	3,420	0.05	0.5	0.025	0.085
Cyclotron Machine Removal, Package and Dispose of Waste	8,340	0.2	0.5	0.1	0.834
Concrete and Soil Removal, Package and Dispose of Waste	2,480	0.009	0.8	0.0072	0.018
Final Status Survey[b]	0	0	0	0	0
Total Hours	**14,240**	**Person-Rem Estimate Total**			**0.937**

[a] Anticipated dose rate reduction factor due to shielding installation, source removal, or decontamination.
[b] No dose was estimated for Phase 4 since essentially all cyclotron-related radioactive material is expected to be removed during remediation.
Key: mrem/hr=millirem per hour.

Under the Proposed Action, the estimated worker dose would be 0.937 person-rem, with most of that dose (98 percent) associated with the cyclotron machine removal and packaging for disposal as waste. Conservatively assuming that one-third, or 5 employees per year, would be doing most of the work in radiation fields, this would equate to each employee being exposed to 0.03 rem per year. These estimated exposures are well below the regulatory limit of 5 rem per year and NASA's more-conservative 0.5-rem-per-year threshold.

A Radiation Protection Program is currently in place and would continue for all aspects of decontamination, decommissioning, and demolition at the Cyclotron Facility. The program ensures that operations are performed to ensure that potential risks resulting from ionizing radiation exposures are maintained as low as reasonably achievable (ALARA). Potential doses from inhalation of airborne radioactivity are expected to be mitigated by incorporating ALARA concepts and sound radiological controls practices into procedures and work control documents. Examples of ALARA measures include minimizing time spent in the field of radiation, maximizing distances from sources of radiation, using shielding whenever possible, and/or reducing the radiation source.

Mitigation measures used to protect workers from radiological and chemical exposure hazards during decontamination, decommissioning, and demolition activities would be derived from formal radiation protection programs and chemical hazards management programs. Radiation protection mitigation measures would include formal analysis by the workers, supervisors, and radiation protection personnel of the work in a radiological environment and identification of methods to reduce exposure of workers to the lowest practicable level. Contamination and engineering controls would be used to reduce the potential for airborne radioactivity. The primary methods to control occupational exposures at the Cyclotron Facility would be controlling facility access; communicating area hazards through proper training and postings; maintaining knowledge of the current radiological conditions by facility monitoring; using personnel protection equipment (e.g., protective clothing and respirators); and using Radiation Work Permits. Examples of specific measures include personal protective equipment (e.g., Tyvek® suits, face masks), shielding, and training for specific work activities. Entry to the Cyclotron Facility (Building 140) would be controlled by Health Physics staff during operating hours. During non-operating hours, the building would be locked, posted, and/or secured to prevent unauthorized access. These mitigation measures would comply with applicable Federal and state safety requirements.

3.12 UTILITIES INFRASTRUCTURE

3.12.1 Affected Environment

The primary utilities infrastructure at Lewis Field include domestic water supply, electrical power, and fuels. Domestic water is purchased from the City of Cleveland, and distributed through water supply lines, with an average daily water consumption in 2013 of approximately 1,750,000 liters (460,000 gallons). Power is supplied by the local electric utility and distributed at voltages ranging from 13.8 kilovolts down to 120 volts. The total annual power consumption in 2013 was approximately 190,000 megawatt-hours. Lewis Field is provided natural gas by contract, with the commodity being provided by Energy Services Provider Group of Baltimore, Maryland, and distributed by Dominion East Ohio Gas Company of Ohio. The total annual natural gas consumption at Lewis Field in 2013 was 13.4 million cubic meters (473 million cubic feet) (Patton 2014).

3.12.2 Environmental Consequences

Under the No Action Alternative, Building 140 would remain intact and the cyclotron machine would not be removed. GRC Lewis Field would continue to conduct a variety of research and development projects. There would be no incremental increase in water, electrical, or fuel usage; therefore, no impacts on the existing utility infrastructure at GRC Lewis Field would occur.

Under the Proposed Action, water and fuel consumption would increase, and there would be a negligible change in electricity usage. Water consumption would increase approximately 276,000 liters (72,900 gallons) for personnel use, dust suppression, and cutting tools. Fuel consumption would be approximately 38,000 liters (10,000 gallons) of fuels for operation of a crane, excavation equipment, and light trucks (this does not include the estimated amount of fuel used to transport waste to offsite disposal facilities). The negligible change in electricity would reflect the use of small hand tools such as drills and saws. Under this scenario, heavy equipment usage would be intermittent and anticipated to be less than 25 percent of the time during normal working hours. Utility consumption would be largely offset by a net decrease in utilities used to sustain the operability of Building 140, once the utility connections have been terminated.

3.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.13.1 Affected Environment

3.13.1.1 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the Lewis Field regional area, which includes portions of Lorain, Medina, Summit, Cuyahoga, Geauga, Lake, Erie, Portage, Huron, Ashland, Wayne, Stark, Trumbull, Ashtabula, Richland, and Ottawa Counties (NASA 2008).

3.13.1.1.1 Population

Table 3–6 provides population estimates for the State of Ohio, the Lewis Field regional area, and Cuyahoga County based on 2010 census data. A comparison of race, ethnicity, and income statistics for the population is provided in Section 3.13.1.2.

Table 3–6. Population Estimates for the State of Ohio, Lewis Field Regional Area, and Cuyahoga County

Location	2010 Census
State of Ohio	11,536,504
Lewis Field Regional Area	3,938,102
Cuyahoga County	1,280,122

Source: He 2013.

3.13.1.1.2 Economy

This section provides an overview of the economy by describing employment and occupations, places of residence for employees, revenues, and expenditures.

The NASA GRC labor force is made up of two components: civil service employees and local contractors. In fiscal year (FY) 2012, NASA GRC employed approximately 1,690 on- or near-site contractors and approximately 1,660 civil service employees. The number of contractors reflects the NASA GRC's need for specific tasks and services, and therefore fluctuates depending on the amount and nature of work at the site. Significant employment is provided in the following civil service occupational categories: administrative professional, clerical, scientists and engineers, and technicians. Scientists and engineers accounted for the largest occupational category of civil service employees at 67 percent in FY 2012. Between FY 2009 and FY 2010, the number of local contractors grew by approximately 2 percent, but decreased by approximately 12 percent from FY 2010 to FY 2012. The number of civil service employees is relatively constant, allowing for retention of core experts. Civil employment peaked in FY 2011, but has since decreased by 3 percent through the end of FY 2012. The vast majority of Lewis Field's workforce lives in Cuyahoga County or other surrounding counties that make up northeast Ohio (Lendel and Lee 2013).

3.13.1.2 Environmental Justice

Minority individuals are defined as members of the following population groups: American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, some other race, and Hispanic or Latino. The "some other race" category includes all other responses not included in the White, Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander race categories. Respondents reporting entries such as multiracial, mixed, interracial, or a Hispanic or Latino group (for example, Mexican, Puerto Rican, Cuban, or Spanish) in response to the race question are included in this category. The Hispanic or Latino category includes all persons who identify themselves as Hispanic or Latino regardless of race. People reporting two or more races are considered minority individuals (SAIC 2013).

Persons whose incomes are less than the poverty threshold are defined as low-income persons by the Council on Environmental Quality (CEQ 1997). In 2010, the poverty threshold for a family of four with two related children was $22,113 (SAIC 2013).

NASA GRC updated its Environmental Justice Implementation Plan in 2013 (SAIC 2013). **Table 3–7** provides a comparison of race, ethnicity, and income statistics from the 2013 Environmental Justice Implementation Plan for nearby neighborhoods, the City of Cleveland, Cuyahoga County, and the State of Ohio within an 8-kilometer (5-mile) radius of Lewis Field. **Figures 3–1** and **3–2** are maps of the minority populations and low-income populations in the vicinity of Lewis Field, respectively.

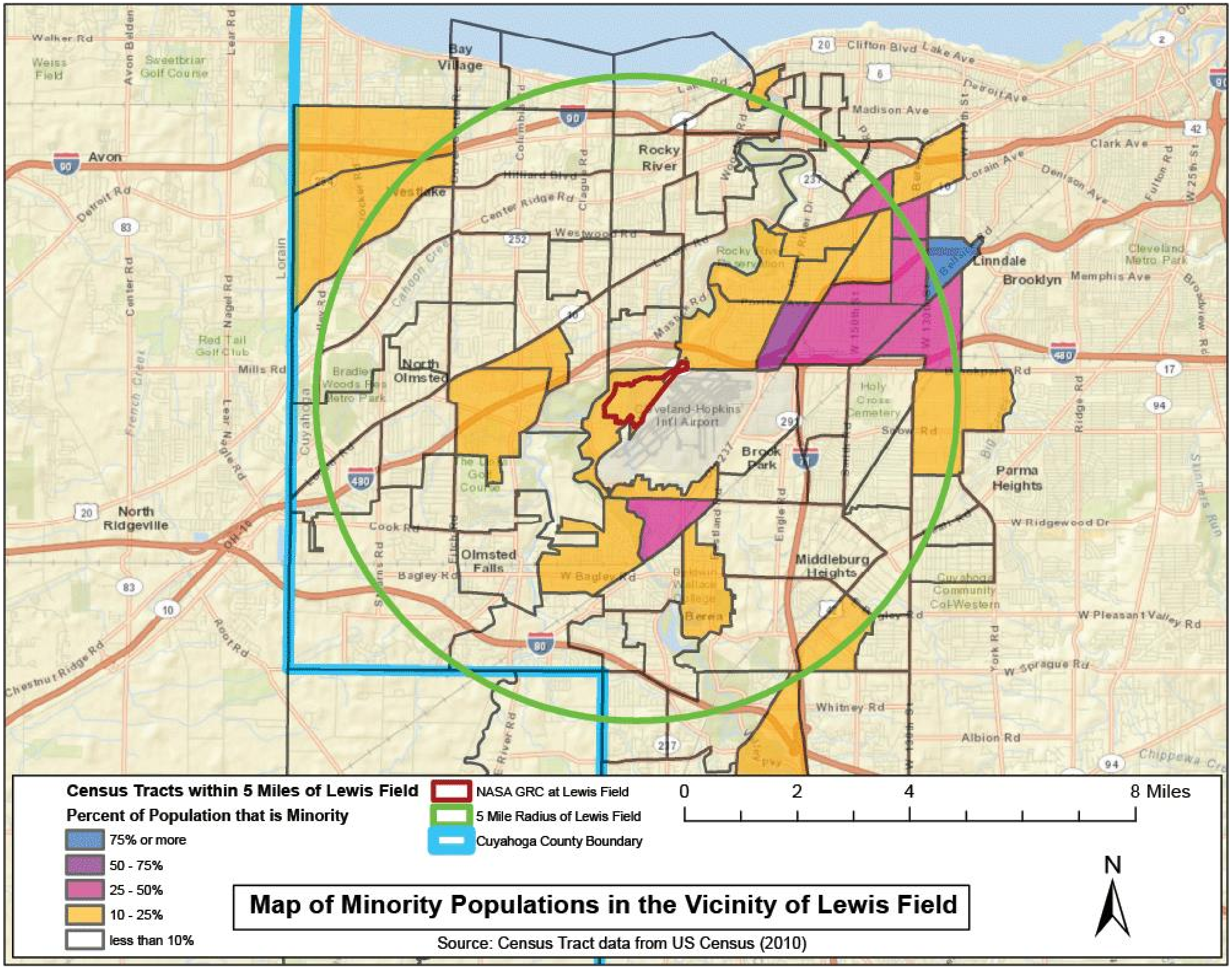
Table 3–7. Lewis Field Comparative Race, Ethnicity, and Income Statistics

Indicator	Brook Park	Fairview Park	North Olmsted	City of Cleveland	Cuyahoga County	State of Ohio
Total Population	19,212	16,826	32,718	396,815	1,280,122	11,536,504
Percent White, Non-Hispanic	90	92.2	90.4	33.4	61.4	81.1
Percent Minority	10	7.8	9.6	66.6	38.6	18.9
Percent Black or African American	3.2	1.8	2.0	53.3	29.7	12.2
Percent Hispanic[a]	3.4	3.3	3.5	10	4.8	3.1
Median Household Income in Dollars[b]	51,967	54,011	57,668	27,470	44,088	48,071
Percent Below Poverty Level[b]	7.4	6.7	6.3	32.6	17.1	14.8

[a] Includes all persons who indicated Hispanic or Latino ethnicity regardless of race.

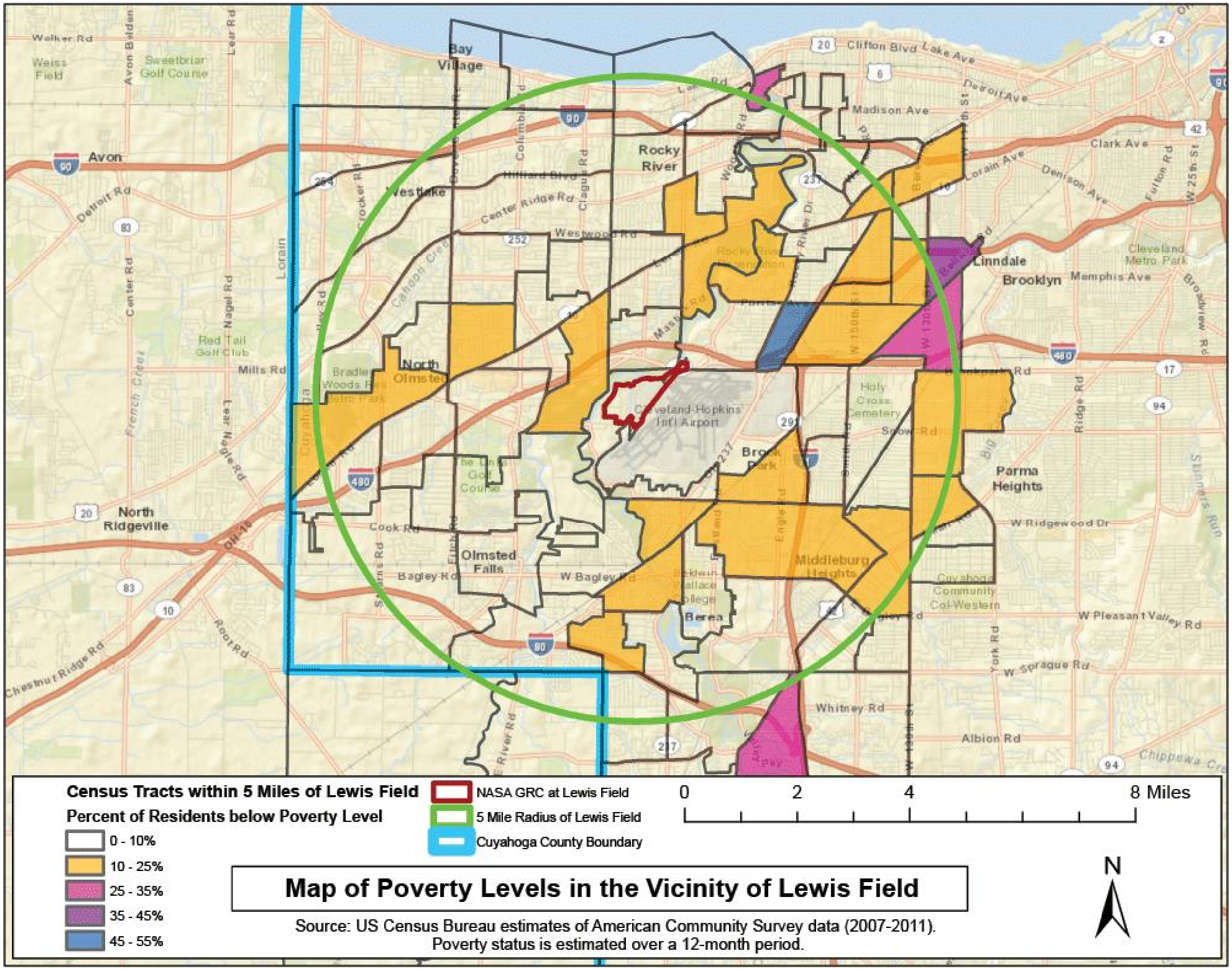
[b] American Community Survey 2007–2011 estimates in 2011 dollars.

Source: SAIC 2013.



Source: Reproduced from SAIC 2013.

Figure 3–1. Minority Populations Near Lewis Field



Source: Reproduced from SAIC 2013.

Figure 3–2. Low-Income Populations Near Lewis Field

3.13.2 Environmental Consequences

3.13.2.1 Socioeconomics

Additional employees would not be required under the No Action Alternative; therefore, there would be no impacts on socioeconomic conditions (i.e., overall employment and population trends).

Under the Proposed Action, it is estimated that a workforce of approximately 15 employees per year would be needed until project completion, which is anticipated to require three years. The Proposed Action activities would require a combination of civil service employees and local contractors. The professional and construction-related work would be intermittent and varied, depending on the nature of the decontamination, decommissioning, and demolition activities. For example, removal of the cyclotron machine and interference equipment would involve mostly craft labor using hand tools, whereas heavy equipment operators would be needed for demolition of subgrade building structures.

The increase in employees required under the Proposed Action would account for less than 1 percent of the total number of employees employed by NASA GRC in 2012 (1,690 on- or near-site contractors and 1,660 civil service); therefore, the impacts on socioeconomic conditions would be minor.

3.13.2.2 Environmental Justice

Council on Environmental Quality (CEQ) guidance recommends identifying minority populations where either the minority population of the affected area exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Meaningfully greater is defined here as 20 percentage points greater than the minority population percentage in the general population. The thresholds used to identify low-income populations follow the same methodology as described above for identifying minority populations, using data relative to income (SAIC 2013).

The region of potential influence for Lewis Field includes the immediately surrounding communities of the City of Cleveland to the east, Brook Park to the south and west, Fairview Park to the north, and North Olmsted to the west. For evaluation purposes, the region of potential influence is also assumed to contain those portions of Cuyahoga and Lorain Counties within an 8-kilometer (5-mile) radius of Lewis Field. Since the majority of the 83 potentially affected census tracts lie within Cuyahoga County (only 2 tracts are in Lorain County) within the 8-kilometer (5-mile) radius, the general population was defined as the State of Ohio and Cuyahoga County (SAIC 2013).

According to the 2010 census, the minority population percentage of the state of Ohio and Cuyahoga County was 18.9 percent and 38.6 percent, respectively. Therefore, the threshold for identifying minority populations is 50 percent, which is less than 58.6 percent (20 percentage points above the minority population percentage of Cuyahoga County). According to the *2007–2011 American Community Survey 5-Year Estimates*, the low-income population percentage of the State of Ohio and Cuyahoga County was 14.8 percent and 17.1 percent, respectively. Therefore, the threshold for identifying low-income populations is 37.1 percent—20 percentage points above the low-income population percentage of Cuyahoga County (SAIC 2013). Utilizing these threshold values, two tracts were identified in the 2013 Environmental Justice Implementation Plan as containing meaningfully greater minority populations, and the same two tracts were also identified as containing meaningfully greater low-income populations. The nearest minority and low-income census tract is approximately 1.6 kilometers (1.0 mile) from Lewis Field. This tract is within Cleveland's Riverside Neighborhood and contains the Cuyahoga Metropolitan Housing Authority's Riverside Park subsidized housing complex. The other minority and low-income tract lies greater than 6.4 kilometers (4 miles) northeast of Lewis Field in Cleveland's Puritas-Longmead neighborhood. The environmental impacts of the Proposed Action would be none to negligible for all resource areas. Therefore, there would be no high and adverse impacts on the minority or low-income populations identified in the 2013 Environmental Justice Implementation Plan.

3.14 SUMMARY OF IMPACTS

Table 3–8 presents a summary description of impacts for the Proposed Action and the No Action Alternative. Environmental impacts evaluated in this *Cyclotron EA* were determined to range from none to negligible. Resource areas evaluated as not having the potential for adverse impacts under the Proposed Action include land use, visual resources, geology and soils, ecological resources, cultural resources, utilities infrastructure, and socioeconomics and environmental justice. Resource areas that have the potential for some, but still negligible, adverse impacts include air quality, noise, water resources, waste management, transportation, and health and safety. Implementing best management practices and maintaining compliance with Federal, state, and local environmental laws and regulations would ensure adverse impacts remain negligible for these resource areas. The Proposed Action would require three years to complete all work.

Table 3–8. Summary of Impacts

<table>
<tr><th>Resource Area</th><th>No Action</th><th>Proposed Action</th></tr>
<tr><td>Land Use</td><td>No impacts. Access and use of building would remain restricted.</td><td>Approximately 0.3 hectares (0.7 acres) of land disturbance to excavate entire Building 140.</td></tr>
<tr><td>Visual Resources</td><td>No impacts.</td><td>Above-grade structures and mound would be removed and restored to level grade.</td></tr>
<tr><td>Geology and Soils</td><td>No impacts.</td><td>Approximately 3,160 cubic meters (111,000 cubic feet) of import fill would be required.</td></tr>
<tr><td>Air Quality</td><td>No impacts.</td><td>Criteria pollutants from combustion of approximately 38,000 liters (10,000 gallons) of diesel fuel. Fugitive dust from exposed earth.</td></tr>
<tr><td>Noise</td><td>No impacts.</td><td>Potential noise sources from hand tools such as cutting and drilling, as well as some heavy equipment use (crane, excavators, trucks, etc.). Noise generated during decontamination and decommissioning activities would generally blend in with noise from other sources at Lewis Field or the adjacent airport; however, some noise during normal working hours may intermittently affect NASA employees in adjacent buildings such as Building 49.</td></tr>
<tr><td>Water Resources</td><td>No impacts on water resources. No wetlands or flood zones are associated with Building 140.</td><td>No impacts on water resources. No wetlands or flood zones associated with the project. Best management practices for erosion and sediment control would be implemented during excavation to prevent potential adverse impacts from stormwater runoff.</td></tr>
<tr><td>Ecological Resources</td><td colspan="2">No impacts on flora or fauna expected. Project site and surrounding area are highly developed with no protected species known to be associated with the project site.</td></tr>
<tr><td>Cultural Resources</td><td colspan="2">Cyclotron Facility lies within the GRC Lewis Field National Register of Historic Places-eligible historic district; however, it is a non-contributing element.</td></tr>
<tr><td>Waste Management</td><td>No impacts.</td><td>Up to 2,200 cubic meters (78,000 cubic feet) of low-level radioactive waste. Some hazardous building materials (e.g., polychlorinated biphenyl ballasts and asbestos).</td></tr>
<tr><td>Transportation[a]</td><td>No impacts.</td><td>Up to 157 truck shipments (or 80 rail shipments). For truck shipments, the cumulative dose would be 3.8 person-rem to the crew and 1.5 person-rem to the public. For rail shipments, the cumulative dose would be 0.69 person-rem to the crew and 1.0 person-rem to the public. No fatalities would be expected under either incident-free or accident scenarios.</td></tr>
<tr><td>Health and Safety[a]</td><td>Radiological contamination would remain in place.</td><td>Cumulative worker dose would be approximately 0.937 person-rem. All radiological contamination would be removed from Building 140.</td></tr>
<tr><td>Utilities Infrastructure</td><td>No incremental change in consumption of utilities used to maintain Building 140 in its current state.</td><td>Building 140 would no longer exist and utilities would be disconnected. Use of utilities would decrease to zero.</td></tr>
<tr><td>Socioeconomics and Environmental Justice</td><td>No impacts.</td><td>Approximately 15 full-time equivalent employees would be required per year. Any impacts of the Proposed Action would be contained within the boundary of GRC Lewis Field and would be negligible for all resource areas. Therefore, there would be no high and adverse impacts on minority or low-income populations.</td></tr>
</table>

[a] A person-rem is the collective radiation dose to a population or group of people.

Key: GRC=Glenn Research Center; NASA=National Aeronautics and Space Administration; rem=Roentgen equivalent man.

3.15 CUMULATIVE IMPACTS

The cumulative impacts analysis has been conducted in accordance with the CEQ regulations that implement NEPA and the CEQ handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997).

3.15.1 Methodology and Analytical Baseline

The CEQ regulations implementing NEPA (40 CFR Part 1508) define cumulative effects as "impacts on the environment which result from the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." The regulations further explain that "cumulative effects can result from individually minor but collectively significant actions taking place over a period of time." The cumulative impacts assessment is based on both geographic and time considerations.

Cumulative impacts are evaluated in this *Cyclotron EA* for past, present, and foreseeable activities within Lewis Field and in nearby portions of Cuyahoga and Lorain Counties. The general approach to the analysis involves the following process:

- Baseline impacts from past and present actions were identified.
- The potential impacts anticipated by the decontamination, decommissioning, and demolition of the Cyclotron Facility were identified.
- Reasonably foreseeable future actions were identified.
- Cumulative impacts of the Proposed Action were estimated.

The analysis of the decontamination, decommissioning, and demolition of the Cyclotron Facility at GRC Lewis Field determined that impacts on the various resources areas would be negligible in all cases. In keeping with CEQ regulations, where impacts on resources are predicted not to occur or would be negligible, cumulative impacts were not analyzed since there would be either no, or only a very small incremental increase in, impacts on the resource area. This does not mean that other site activities associated with the resource areas are negligible; it means that impacts associated with the decontamination, decommissioning, and demolition of the Cyclotron Facility would have a negligible contribution to their cumulative impacts.

3.15.2 Potential Cumulative Impacts from Onsite and Offsite Activities

Actions that may contribute to cumulative impacts include on- and offsite projects conducted by government agencies, businesses, or individuals that are within and nearby Lewis Field. A review of possible cumulative impacts indicates a very low potential for any significant contribution to offsite cumulative environmental impacts under the Proposed Action when combined with other activities at Lewis Field or offsite. The proposed activities from the GRC Master Plan Environmental Assessment (NASA 2008) that were considered are provided in **Table 3–9**. Other activities near Lewis Field with potential cumulative environmental impacts include: transportation arteries (Interstate Highways 480 and 71) around the site, Cleveland Hopkins International Airport, Ford Motor Company, General Motors Corporation, and a shopping complex (SAIC 2013).

Table 3–9. Actions from the Glenn Research Center Master Plan Environmental Assessment that May Contribute to Cumulative Impacts

Location	Description
Onsite NASA Action	Proposed Construction of Facilities (2012–2016): • Rehabilitation of: Compressor and Turbine Research Facility, Propulsion Systems Laboratory (PSL), Power Substation, Instrument Research Laboratory, Supersonic Wind Tunnel Complex Building, Liquid Metals Power Laboratory, Part of PSL Complex, Fuel Cell Testing Facility, New Security Fencing, Sewer System, Storm and Industrial Waste Sewer System • Construction of: PSL Engine Testing Building
	Capping the landfill in the South Area of Lewis Field
Offsite Action	Continued operations and improvements at Cleveland Hopkins International Airport
	Continuing development in the City of Cleveland

Key: NASA=National Aeronautics and Space Administration.

3.15.3 Potential Cumulative Impacts from Offsite Transportation

The impacts from transportation in this *Cyclotron EA* are quite small compared with overall cumulative transportation impacts. The collective worker dose from all types of shipments was estimated to be about 421,000 person-rem (253 LCFs) for the period from 1943 through 2073 (131 years). The general population collective dose was estimated to be about 437,000 person-rem (262 LCFs). Worker and general population collective doses as estimated in this *Cyclotron EA* range from 0 to 3.8 person-rem and from 0 to 1.5 person-rem, respectively, for truck shipments, with no LCFs expected. Doses associated with rail shipments are expected to range from 0 to 0.069 person-rem for worker collective dose and from 0 to 1.0 person-rem for general population collective dose, with no LCFs expected. To place these numbers in perspective, the National Center for Health Statistics indicates that the annual average number of cancer deaths in the United States from 1999 through 2004 was about 554,000, with less than a 1 percent fluctuation in the number of deaths in any given year (CDC 2012). The total number of LCFs (among the workers and the general population) estimated to result from radioactive material transportation over the period between 1943 and 2073 is 515, or an average of about 4 LCFs per year. The transportation-related LCFs represent about 0.0002 percent of the overall annual number of cancer deaths; therefore, it is indistinguishable from the national fluctuation in the total annual death rate from cancer. Note that the majority of the cumulative risks to workers and the general population would be due to the general transportation of radioactive material unrelated to activities evaluated in this *Cyclotron EA*.

3.15.4 Climate Change

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere; the accumulation of these gases in the atmosphere has been attributed to the regulation of Earth's temperature. Thus, regulations to inventory and to decrease emissions of GHGs have been promulgated. At this time, a threshold of significance has not been established for the emissions of GHGs, but CEQ has released the *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* (CEQ 2014), which suggests that proposed actions that would reasonably emit 25,000 metric tons or more of carbon-dioxide-equivalent gases should be evaluated by quantitative and qualitative assessments. CEQ considers this is an appropriate reference point that would allow agencies to focus their attention on proposed projects with potentially large GHG emissions. This is not a threshold of significance, but rather a minimum level that would require consideration in NEPA documentation.

The six primary GHGs, defined in Section 19(i) of Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and internationally recognized and regulated under the Kyoto Protocol, are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Each GHG has an estimated global warming potential, which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the Earth's surface. The global warming potential allows GHGs to be compared to each other by converting the GHG quantity into the common unit "carbon-dioxide equivalent."

In the case of the Proposed Action, the primary source of carbon dioxide emissions would be from heavy equipment operating on site and the transportation of waste for offsite disposal. Under the Proposed Action, assuming all waste would be transported by truck to Clive, Utah, the total estimated carbon dioxide emissions that could be released into the atmosphere is 660 metric tons. Due to the relatively short construction period and small project (in terms of number of workers and pieces of equipment necessary), the GHG emissions would not approach or exceed 25,000 metric tons of carbon-dioxide-equivalent gases. Furthermore, the estimated amount of carbon dioxide emissions for this Proposed Action would be insignificant in relation to the estimated 5.98 billion metric tons of carbon dioxide emissions in the United States in 2006 (EPA 2008).

3.16 INCOMPLETE OR UNAVAILABLE INFORMATION

NASA conducted a limited site characterization study that identified hazardous building materials and surface and volumetric radiological contamination (SAIC 2012). However, these characterization results are limited and may not be relied upon for waste profiling or determining the exact extent of decontamination, decommissioning, or demolition that would be required for the Proposed Action. Proper characterization is important for waste minimization and it is required by Federal and state regulations that relate to transportation and disposal facilities. Waste materials would be surveyed and characterized as they are generated and then packaged for shipment and disposal. Procedures would be developed that adequately implement the waste acceptance criteria imposed by the licenses held by disposal sites and waste processors used by the project. Processes would be implemented to assure that nonradioactive building demolition debris disposed of in commercial landfills meets the disposal criteria imposed by regulation or permit requirements at the disposal facility. It is possible that a large portion of the waste generated would not be radioactive. Recent and limited removal and waste profiling of some equipment in Building 140 support this conclusion (SAIC 2012). This *Cyclotron EA* conservatively assumes that all waste projected to be generated under the Proposed Action would be Class A LLW; therefore, the environmental impacts associated with managing and disposing of radioactive waste are potentially overstated. Also, no soil samples beneath Building 140, particularly the Cyclotron Vault Room, have been analyzed for contamination; however, the potential presence of any radioactive contamination in underlying soils is perceived to be low based on previous characterization results.

This page left intentionally blank.

4. AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED

4.1 INTRODUCTION

National Aeronautics and Space Administration (NASA) procedures for implementing the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.) provide the option to make Environmental Assessment documents available for public review and to give stakeholders an opportunity to comment.

4.2 PUBLIC COMMENT PERIOD

The draft *Environmental Assessment for the Decontamination and Decommissioning of Building 140 at GRC Lewis Field* (*Cyclotron EA*) and the preliminary Finding of No Significant Impact (FONSI) were made available to the public from February 20 to March 21, 2015. Notices were published in the Cleveland Plain Dealer, Sun, and West Life newspapers. The draft *Cyclotron EA* and preliminary FONSI were posted on the NASA Headquarters website and were made available at the North Olmstead and Fairview Park (Ohio) Libraries. NASA did not receive any comments on the draft *Cyclotron EA* or preliminary FONSI.

This page left intentionally blank.

5. LIST OF PREPARERS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Ebner, David

EIS Responsibilities:	*NASA GRC Cyclotron Project Manager*
Education:	M.S., Civil Engineering, University of Wisconsin
	M.S., Civil Engineering, Rensselaer Polytechnic Institute
Experience:	31 years

Lallier, Robert

EIS Responsibilities:	*NASA GRC NEPA Program Manager*
Education:	M.S., Environmental Management, University of Findlay
Experience:	27 years

Main, Leslie

EIS Responsibilities:	*NASA GRC Historic Preservation Officer*
Education:	B.S., Mechanical Engineering, Valparaiso University
Experience:	27 years

Blasio, Chris

EIS Responsibilities:	*NASA GRC Health Physicist*
Education:	M.S., Industrial Hygiene, University of Cincinnati
	M.S., Health Physics, University of Cincinnati
	B.E., Electrical Engineering and Mathematics, Vanderbilt University
Experience:	12 years

LEIDOS

Gross, Lorraine

EIS Responsibilities:	*Cultural Resources*
Education:	M.A., Anthropology, Washington State University
	B.A., Anthropology, Pomona College
Experience:	33 years

Heiser, Scott

EIS Responsibilities:	*Leidos Project Manager; Chapter 2, Description and Comparison of Alternatives; Chapter 3, Affected Environment and Environmental Consequences; Air Quality, Noise, Waste Management and Utilities Infrastructure*
Education:	M.S., Engineering Management, University Maryland University College
	B.S., Mechanical Engineering, Virginia Polytechnic Institute and State University
Experience:	22 years

Karimi, Roy
EIS Responsibilities: *Transportation Impacts Analysis*
Education: Sc.D., Nuclear Engineering, Massachusetts Institute of Technology
N.E., Nuclear Engineering, Massachusetts Institute of Technology
M.S., Nuclear Engineering, Massachusetts Institute of Technology
B.Sc., Chemical Engineering, Abadan Institute of Technology
Experience: 36 years

Lawson, Pamela
EIS Responsibilities: *Document Production*
Experience: 32 years

Minichino, Brian
EIS Responsibilities: *Transportation Impacts Analysis*
Education: B.S., Chemistry, Virginia Polytechnic Institute and State University
Experience: 6 years

Outlaw, Douglas
EIS Responsibilities: *Cyclotron Subject Matter Expert; Worker and Public Health and Safety*
Education: Ph.D., Physics, North Carolina State University
M.S., Physics, North Carolina State University
B.S., Physics, North Carolina State University
Experience: 36 years

Owens, Kirk
EIS Responsibilities: *Reviewer*
Education: B.S., Environmental Resource Management, The Pennsylvania State University
Experience: 35 years

Preston, Margaret
EIS Responsibilities: *Chapter 3, Affected Environment and Environmental Consequences; Water Resources, Geology and Soils, Socioeconomics, and Environmental Justice*
Education: B.S., Environmental Science, University of Maryland Baltimore County
Experience: 8 years

Riley, Elizabeth
EIS Responsibilities: *Document Production*
Education: B.A., Psychology, The Catholic University of America
Experience: 3 years

Schoo, Nicole
EIS Responsibilities: *Chapter 1, Purpose and Need for the Action; Chapter 4, Agencies and Persons Consulted; Land Use, Visual Resources, and Ecological Resources*
Education: B.S., Biology, Indiana University
Experience: 4 years

Smith, Alison
EIS Responsibilities: *Technical Editor*
Education: B.A., English Language and Literature, University of Maryland, College Park
Experience: 6 years

Upchurch, Audra
EIS Responsibilities: *Chapter 1, Purpose and Need for the Action; Chapter 3, Affected Environment and Environmental Consequences*
Education: M.N.R., Natural Resources, Virginia Polytechnic Institute and State University
B.S., Forestry, Virginia Polytechnic Institute and State University
Experience: 14 years

6. REFERENCES

Butowsky, H. A., 1984, *Man in Space National Historic Landmark Theme Study*, National Park Service, accessed through http://www.cr.nps.gov/history/online_books/butowsky3/spacet.htm.

CDC (Centers for Disease Control and Prevention), 2012, Deaths, Percent of Total Deaths, and Death Rates for the 15 Leading Causes of Death in 5-Year Age Groups, by Race and Sex, United States, 1999–2008, National Center for Health Studies, March 30.

CEQ (Council on Environmental Quality), 1997, *Considering Cumulative Effects Under the National Environmental Policy Act*, Executive Office of the President, Washington, D.C., January.

CEQ (Council on Environmental Quality), 2014, *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*, December.

DOE (U.S. Department of Energy), 1997, *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2, Carlsbad Area Office, Carlsbad, New Mexico, September.

DOE (U.S. Department of Energy), 2003, *Air, Water, and Radiation Info Brief: Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE)*, ISCORS Technical Report No. 1, Office of Environmental Policy and Guidance, DOE/EH-412/0015/0802, Rev. 1, Washington, D.C., January.

DOT (U.S. Department of Transportation), 2012a, *Motor Carrier Safety Progress Report (as of 9/30/12)*, DOT-HS-809-919, Federal Motor Carrier Safety Administration, Washington, D.C., accessed through www.fmcsa.dot.gov/ facts-research/art-safety-progress-report.htm, September.

DOT (U.S. Department of Transportation), 2012b, *Traffic Safety Facts 2010 Data*, DOT HS 811 630, National Highway Traffic Safety Administration, National Center for Statistics and Analysis, Washington, D.C., June.

Energy*Solutions*, 2014, *Cask Book for Model 14/210 and 14/215H*, Rev. 19, Columbia, South Carolina.

EnviroScience (EnviroScience, Inc.), 2012, *Wetlands and Other Waters Delineation Report: NASA Lewis Field, Approximately 300 Acres in Cleveland, Cuyahoga County, Ohio*, November 19.

EPA (U.S. Environmental Protection Agency), 2008, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006*, April 15.

FAA (Federal Aviation Administration), 2000, *Cleveland Hopkins International Airport Final Environmental Impact Statement*, June.

FAA (Federal Aviation Administration), 2014, Cleveland-Hopkins International Airport Information, accessed through http://airnav.com/airport/KCLE, February 6.

FHWA (Federal Highway Administration), 2006, *Construction Noise Handbook*, FHWA-HEP-06-015, accessed through http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm, August.

Gray & Pape (Gray & Pape, Inc.), 2008, *Cultural Resources Management Plan for NASA Glenn Research Center at Lewis Field and Plum Brook Station*, Cincinnati, Ohio.

He, J., 2013, *Population Projections: Ohio County Totals for 2015–2040*, Ohio Development Services Agency, accessed through http://development.ohio.gov/files/research/P6090.pdf, March 30.

Johnson, P. E., and R. D. Michelhaugh, 2003, *Transportation Routing Analysis Geographic Information System (TRAGIS) – User's Manual*, ORNL/NTRC-006, Rev. 0, U.S. Department of Energy, Oak Ridge National Laboratory, accessed through http://apps.ntp.doe.gov/tragis/tragis.htm, June.

Lendel, I., and E. Lee, 2013, *The NASA Glenn Research Center: An Economic Impact Study Fiscal Year 2012*, Cleveland State University, Maxine Goodman Levin College of Urban Affairs, Center for Economic Development, Cleveland, Ohio, June.

mbi/k2m and Westlake (mbi/k2m Architecture Inc. and Westlake Reed Leskosky), 2013, *Architectural Resources Survey for NASA Glenn Research Center at Lewis Field*, January.

MHF (MHF Services), 2014, *Lift Liner Product Information*, U.S. Patent Number 6,079,934, 2014.

NASA (National Aeronautics and Space Administration), 2008, *Final Environmental Assessment for the NASA Glenn Research Center Master Plan*, Cleveland, Ohio, December 12.

NASA (National Aeronautics and Space Administration), 2013a, *Final Environmental Resources Document for National Aeronautics and Space Administration Glenn Research Center at Lewis Field and Plum Brook Station,* July.

NASA (National Aeronautics and Space Administration), 2013b, *Section 106 Review Project Summary, Demolition of Materials and Structures Auxiliary Building 140, The Cyclotron*. Form provided to Ohio Historic Preservation Office Resource Protection and Review with cover letter from Leslie A. Main, NASA Glenn Research Center Historic Preservation Office, to Mr. Mark J. Epstein, Ohio State Historic Preservation Office, August 30.

ODNR (Ohio Department of Natural Resources), 2012, "Ohio Division of Wildlife Natural Heritage Database State-listed Species for Cuyahoga County," accessed through http://wildlife.ohiodnr.gov/species-and-habitats/state-listed-species-by-county, November 8.

OHI (Ohio Historic Inventory), 1996, Historic Building Inventory Forms, Lewis Field. Forms on file at OHI and NASA Glenn, Lewis Field.

Parsons (Parsons Engineering Science, Inc.), 2000, *Phase I Archaeological Report, Proposed Facility Relocation Site NASA Glenn Research Center at Plum Brook Station, Erie County, Ohio*, September.

Patton, E. J., 2014, NASA Glenn Research Center, Lewis Field, personal communication (email) to D. Ebner, NASA, "*GRC Energy and Water Consumption Report*," October 8.

RUDCO (RUDCO Products, Inc.), 2014, *Roll-Off Container Fact Sheet*, Vineland, New Jersey.

SAIC (Science Applications International Corporation), 2012, *Final Site Characterization Report, NASA GRC Cyclotron Facility, Cleveland, Ohio*, Sandusky, Ohio, October.

SAIC (Science Applications International Corporation), 2013, *Final Environmental Justice Plan for National Aeronautics and Space Administration Glenn Research Center, Cleveland, OH*, June.

Saricks, C., and M.M. Tompkins, 1999, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination*, ANL/ESD/TM-150, Center for Transportation Research, Argonne National Laboratory, U.S. Department of Energy, Argonne, Illinois, April.

SNL (Sandia National Laboratories), 2009, *RadCat 3.0 Users Guide*, SAND2009-5129P, Albuquerque, New Mexico and Livermore, California, May.

UMTRI (University of Michigan Transportation Research Institute), 2003, "Evaluation of the Motor Carrier Management Information System Crash File, Phase 1," UMTRI-2003-6, Ann Arbor, Michigan, March.

USFWS (U.S. Fish and Wildlife Service), 2014, "Ohio Federally-Listed Threatened, Endangered, Proposed, and Candidate Species' County Distribution," accessed through www.fws.gov/midwest/endangered/lists/ohio-cty.html, December.

White House (The White House), 2014, "*Presidential Memorandum – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators*," June 20.

Code of Federal Regulations

10 CFR Part 20, U.S. Nuclear Regulatory Commission, "Standards for Protection Against Radiation."

10 CFR 20.1402, U.S. Nuclear Regulatory Commission, "Radiological criteria for unrestricted use."

10 CFR 20.2006, U.S. Nuclear Regulatory Commission, "Transfer for disposal and manifests."

10 CFR 30.36, U.S. Nuclear Regulatory Commission, "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas."

10 CFR Part 61, U.S. Nuclear Regulatory Commission, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR Part 71, U.S. Department of Energy, "Packaging and Transportation of Radioactive Material."

14 CFR Part 77, National Aeronautics and Space Administration, "Safe, Efficient Use, and Preservation of the Navigable Airspace."

14 CFR 1216.3, National Aeronautics and Space Administration, "Procedures for Implementing the National Environmental Policy Act (NEPA)."

29 CFR 1910.95, Occupational Safety and Health Administration, "Occupational noise exposure."

40 CFR Part 93, U.S. Environmental Protection Agency, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans."

40 CFR Parts 1500–1508, Council on Environmental Quality, Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.

49 CFR Parts 171–180, U.S. Department of Transportation, "Hazardous Materials Regulations."

49 CFR Part 173, U.S. Department of Transportation, "Shippers: General Requirements for Shipments and Packaging."

Executive Orders

Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, October 8, 2009.

United States Code

16 U.S.C. 470 et seq., National Historic Preservation Act.

16 U.S.C. 661 et seq., Fish and Wildlife Coordination Act.

16 U.S.C. 1531 et seq., Endangered Species Act.

42 U.S.C. 4321 et seq., National Environmental Policy Act of 1969.

42 U.S.C. 6901 et seq., Resource Conservation and Recovery Act of 1976.

42 U.S.C. 15801 et seq., Energy Policy Act of 2005.