

NASA LEWIS RESEARCH CENTER
PLUM BROOK STATION
ERIE COUNTY, SANDUSKY, OHIO

ENVIRONMENTAL ASSESSMENT
FOR
OPERATION OF THE
SPACECRAFT PROPULSION RESEARCH FACILITY

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The objective of this Environmental Assessment is to review the conditions resulting from the operation of the NASA Spacecraft Propulsion Research Facility (B-2) located at Plum Brook Station, near Sandusky, Ohio.

Approved By:

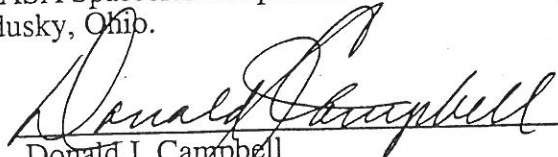

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TABLE 1 - LIST OF ACRONYMS

AREP	Atlas Reliability Enhancement Program
B-2	Spacecraft Propulsion Research Facility
dB	Decibels
dBA	Decibels, "A" weighted (to correspond to human ear response)
EA	Environmental Assessment, a document specified by NEPA
ELV	Expendable Launch Vehicle
EPA	Environmental Protection Agency
FY	Fiscal Year (October 1 - September 30 the following year)
HTF	Hypersonic Tunnel Facility
L _{dn}	Average noise level for an entire 24 hour period
LeRC	NASA Lewis Research Center, located near Cleveland, Ohio
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PBS	NASA Plum Brook Station, a satellite location of LeRC located near Sandusky, Ohio
TWA	Time Weighted Average

I SUMMARY

The following Environmental Assessment (EA) has been prepared in anticipation of a proposed action to fully operate the Spacecraft Propulsion Research Facility (B-2) at the NASA Lewis Research Center (LeRC), Plum Brook Station (PBS), near Sandusky, Ohio. This proposed operation is intended to support research, development, and acceptance testing of rocket engines, upper stage launch vehicles, and other space hardware. This is a unique facility with the capability to perform altitude testing of liquid oxygen and hydrogen fueled rocket engines and upper stage launch vehicles at full thrust. It can also perform long-term thermal-vacuum testing to simulate the on-orbit space environment conditions. No other single facility in this country duplicates all these capabilities. The proposed action and alternatives considered in this EA are listed below.

- A. Operation of B-2 at NASA, Plum Brook Station, near Sandusky, Ohio.
- B. No operation of B-2, or analogous operations elsewhere.
- C. Duplication of B-2 operations at an alternate (unspecified) site.

The impacts that these three options would have on twelve environmental parameters have been determined and are summarized in Table 1. Under the heading of Proposed Action, the question "Are Substantial Impacts Possible?" is addressed as either "Not Expected" or "Possible". The answer "Not Expected" implies that our assessment of the available information indicates that there is little likelihood of substantial environmental effects associated with the proposed action. The answer "Possible" implies that our assessment indicates some environmental impacts are possible or likely. The final two columns compare the expected environmental impacts of the alternatives against the proposed action.

In general, the environmental parameters expected to be most strongly impacted by the proposed action are noise related, with factors such as water resources, solid and hazardous wastes, and air emissions also being impacted. Noise is a result of operating the steam ejector system which is required to maintain altitude conditions during engine firing.

The following mitigation factors are in place or are planned.

- A. Facility Operation is limited to approximately six-12 minute runs within a 24 hour period.
- B. Heavily forested woodland separates the test facility from the nearest residential areas.
- C. Noise monitoring will continue to be performed to identify noise levels in comparison with background community noise levels. When possible, facility operation will be scheduled during periods when generated noise is least noticeable by the general public.
- D. Methods to reduce noise levels generated during testing will be evaluated. Potential solutions to be considered include operating parameters as well as sound reduction techniques and equipment.

**TABLE 2 — SUMMARY OF ENVIRONMENTAL IMPACTS OF
ALTERNATIVES**

<u>Environmental Parameters Considered</u>	<u>Proposed Action, Are Substantial Impacts Possible?</u>	<u>No Action, Impacts Relative to Proposed Action</u>	<u>New Facility Location, Impacts Relative to Proposed Action</u>
Land Resources	No	Similar	Greater
Air Resources	No	Lower	Similar
Water Resources	No	Lower	Similar/Greater
Noise	No	Lower	Greater
Biotic Resources	No	Similar	Similar
Flood plains and Wetlands	No	Similar	Similar/Greater
Solid Waste	No	Lower	Similar/Greater
Hazardous Substance and Hazardous Waste Management	No	Lower	Similar/Greater
Historical, Archeological, and Cultural Factors	No	Greater	Greater
Social and Economic Factors	No	Similar	Similar/Greater
Utilities and Transportation	No	Similar	Similar/Greater
Environmental Justice	No	Similar	Similar

II PURPOSE AND NEED

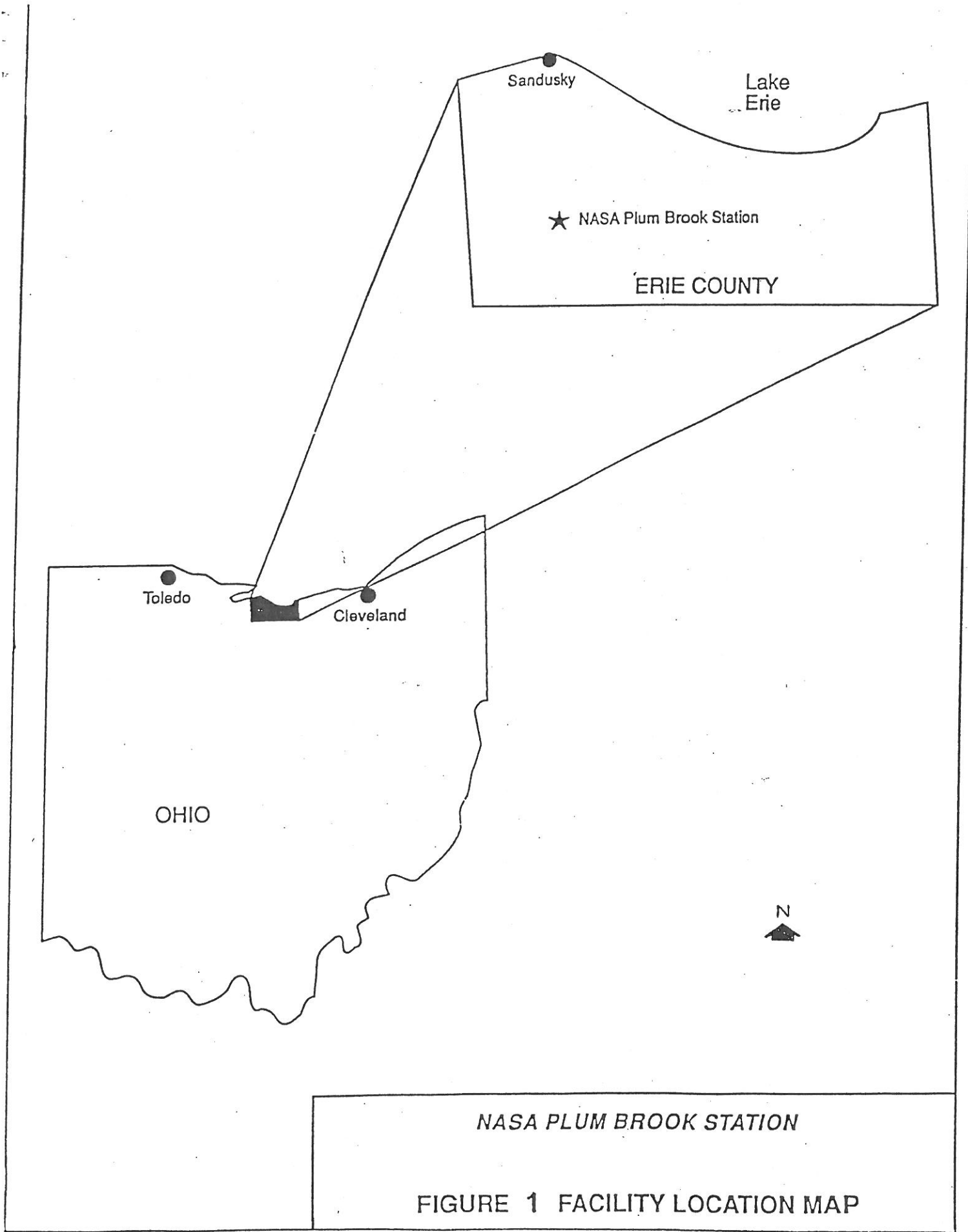
This EA has been prepared in anticipation of the proposed action to operate the NASA Spacecraft Propulsion Research Facility (B-2) located at Plum Brook Station, near Sandusky, Ohio. Preparation of this EA is consistent with the policies set forth in the NASA Lewis Research Center's Environmental Resources Document, Chapter 2, "National Environmental Policy Act (NEPA)", Reference 1, and Lewis Environmental Programs Manual, Chapter 2, "National Environmental Policy Act (NEPA)", Reference 2.

Operation of B-2 is needed to support the nation's Expendable Launch Vehicle (ELV) program. The facility is uniquely able to perform testing which is needed both for improvements of existing propulsion systems, and the development of new ones. No other single facility in the United States can duplicate the capabilities of B-2.

Plum Brook Station (PBS) is a satellite operation of NASA's Lewis Research Center (LeRC) in Cleveland, Ohio. PBS is 83 kilometers (50 miles) west of LeRC, and approximately 7 kilometers (4 miles) south of the Lake Erie port of Sandusky, Ohio (see Figure 1). The area surrounding PBS is primarily rural and agricultural with a low population density. Most areas adjacent to PBS are used for crop production. A small residential area is located adjacent to the PBS northern boundary. PBS encompasses approximately 2,590 hectares (6,400 acres) in Erie County, Ohio. Most of PBS is undisturbed forested land. There are approximately 106 permanent buildings and structures on PBS and 99 munitions bunkers which were constructed when the facility was an ordnance manufacturing plant. The munitions bunkers are currently used for the storage of materials, equipment, and records. The remaining buildings and structures include offices, test facilities, maintenance buildings, storage buildings, and shipping and receiving areas. Other structures on site include substations, sanitary wastewater treatment facilities, and cooling towers. All test facilities at PBS are located remotely from each other for hazard-exclusion distance consideration (see Figure 2). A 2.4 meter (8-foot) high security fence surrounds PBS. Unauthorized site access is prohibited. Access to the site is gained through a security guard house that is staffed 24 hours a day, 7 days a week.

The Spacecraft Propulsion Research Facility (B-2), located at PBS, was originally designed in 1966, with construction complete in 1968. The purpose of the facility was to perform hot-fire testing of large upper-stage rocket engines in an on-orbit environment. During the period of 1969 to 1971 a total of 51 successful test firings of the Centaur upper-stage launch vehicle were completed. These tests involved the simultaneous use of liquid oxygen and liquid hydrogen as the engine propellants, with the steam ejection system providing up to 440 seconds of run time. In 1973 and 1974 the vacuum tank was used to dry out a large quantity of paper documents from the Military Record Facility in St. Louis. The documents had become soaked by water during a fire. Following the successful completion of this task in 1974 the facility was placed in a standby status.

In 1987 the system by system reactivation of B-2 began with the vacuum capability of the test chamber. Several vacuum tests of hardware for another government agency were conducted from 1987 to 1992. In 1994 the cryogenic systems were restored, allowing cold wall operation. This configuration supported testing of the Mars Pathfinder spacecraft. In 1995 the gas purge system, the remainder of the liquid nitrogen system, the cooling water system, and the steam ejector system were restored. The Atlas Reliability Enhancement Program (AREP) was run from 1995 to 1996, making use of the vacuum system, the coldwall, and the liquid oxygen and liquid hydrogen systems. These last two were not operated simultaneously. None of the testing performed since restoration of the facility has involved operation of the steam ejector system, the only aspect of facility operations which has any noticeable impact outside of the building walls.



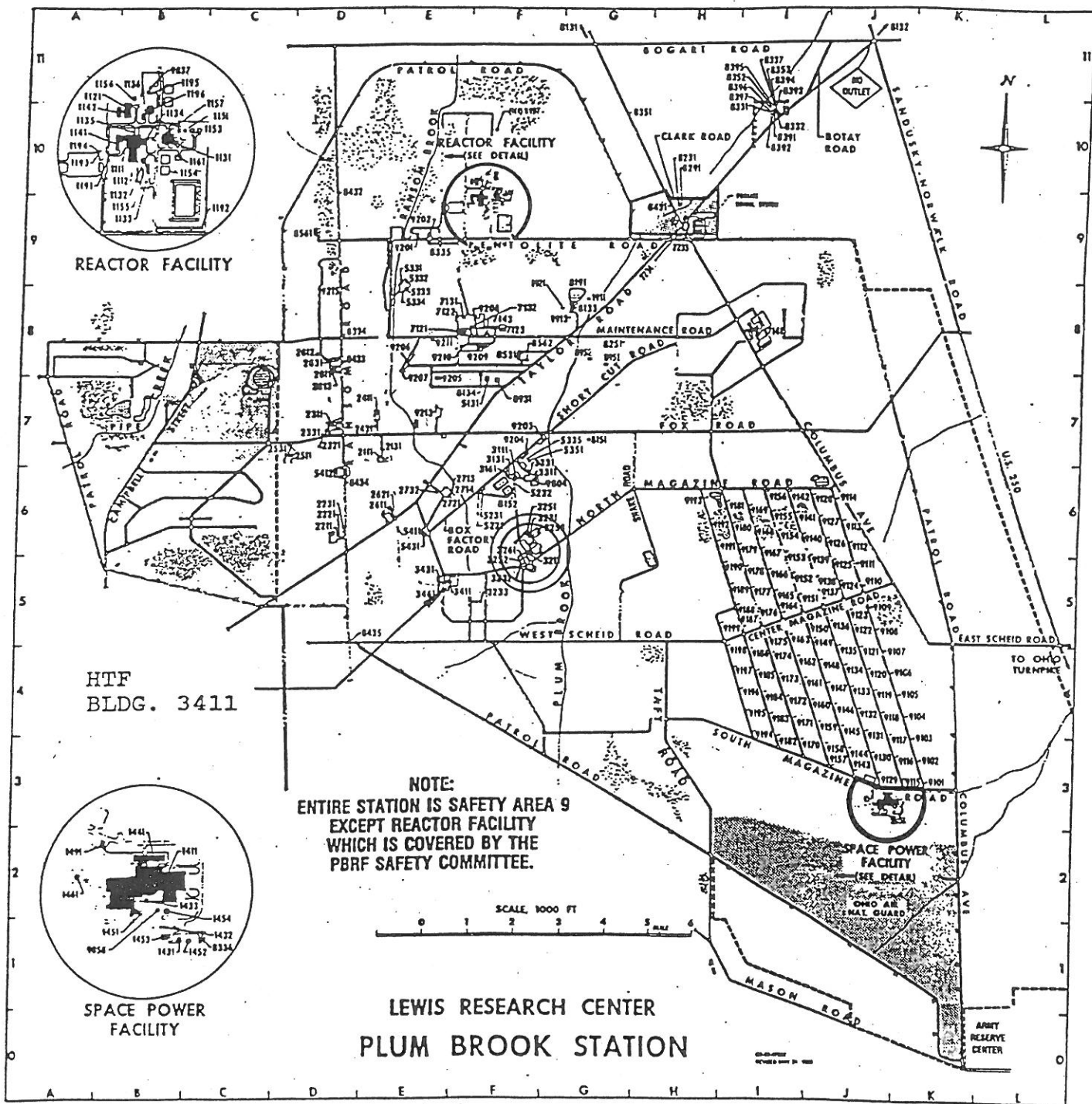


FIGURE 2

The Spacecraft Propulsion Research Facility was designed for research and development testing involving hot-firing of large upper-stage rocket engines using onboard cryogenic fuels and oxidizers as well as storable fuels and oxidizers. The vehicle or system under test can be held for an indefinite time under simulated orbital conditions. The vehicle engines are then fired, simulating either single or multiple burn missions. The facility is designed for engines with up to 400,000 lb thrust. High altitude conditions are maintained before, during, and after the test firing. To simulate altitude conditions, a steam ejector train is used. The steam ejector operates on a venturi principal whereby high pressure steam is injected into the steam ejector resulting in a vacuum in the test chamber as low as 7×10^{-6} torr. High pressure steam is provided by a nearby steam plant (B-Boiler) that was refurbished during the HTF renovation project. The steam plant houses four boilers (operated by either natural gas or #2 fuel oil) capable of supplying 28,000 lbs/hr each of saturated steam at 500 psig to five accumulators. The steam plant also includes a 150 psig auxiliary steam boiler that provides building heat and fuel-atomizing steam for the main boilers. The required Ohio EPA air permits have been obtained for operating these boilers. B-2 test operations are coordinated from a facility known as B-Control (see Figure 4). Original construction costs for B-2 were approximately 35 million dollars. The current value of B-2 and associated equipment (control building, steam plant, and accumulators, etc.) exceeds 150 million dollars.

III DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

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

- A. Operation of B-2 located at NASA's Plum Brook Station near Sandusky, Ohio (referred to hereafter as "Proposed Action").
- B. No action/operations at B-2, or analogous operations elsewhere.
- C. Duplication of B-2 operations at an alternate (unspecified) site.

Each of these choices is briefly described below.

A. Operation of B-2 at NASA's Plum Brook Station (Proposed Action)

The proposed action consists of performing full engine firing tests ranging from a few seconds up to 500 seconds in length, and long duration space environment tests at altitude and on-orbit conditions. Calibration tests as well as engine tests will be performed. Activation of the B-Boiler Building steam plant will also be required to produce steam for facility operation. The facilities will be maintained in good working order to allow them to perform future missions.

B. No Action

This alternative assumes operation of the facility is not to be undertaken, nor are similar tests to be conducted elsewhere.

C. Duplication of B-2 Operations at an Alternate (Unspecified) Site

This alternative assumes that the capabilities and operation of B-2 would be duplicated at an alternative site. While no specific site has been identified, the analysis assumes that a site would be selected that minimizes many of the impacts of the proposed action at the current location. Such impacts include noise effects due to operation of the facility. It is also assumed that an alternate site would not differ

PLUM BROOK SPACECRAFT PROPULSION RESEARCH FACILITY (CUTAWAY VIEW)

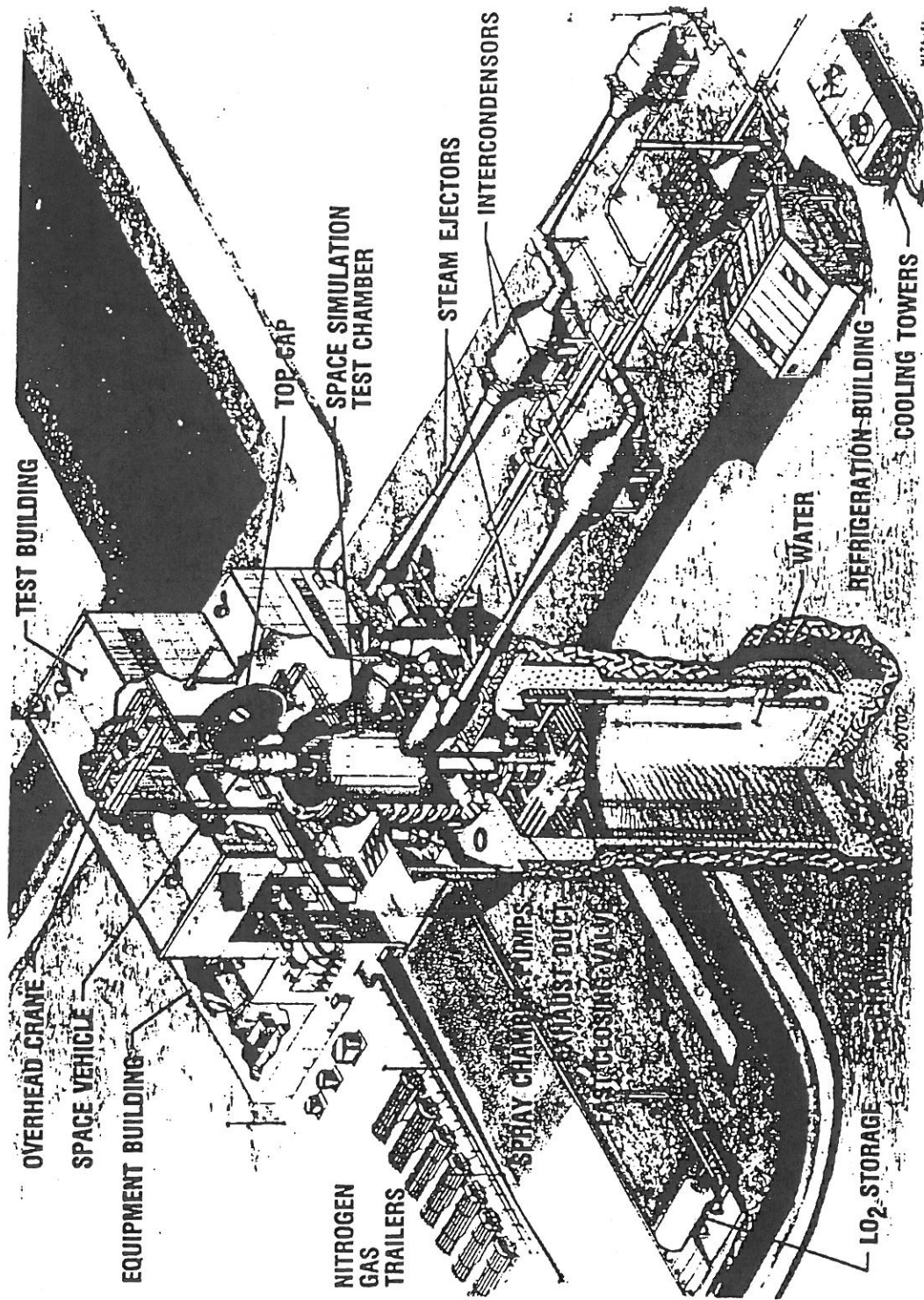
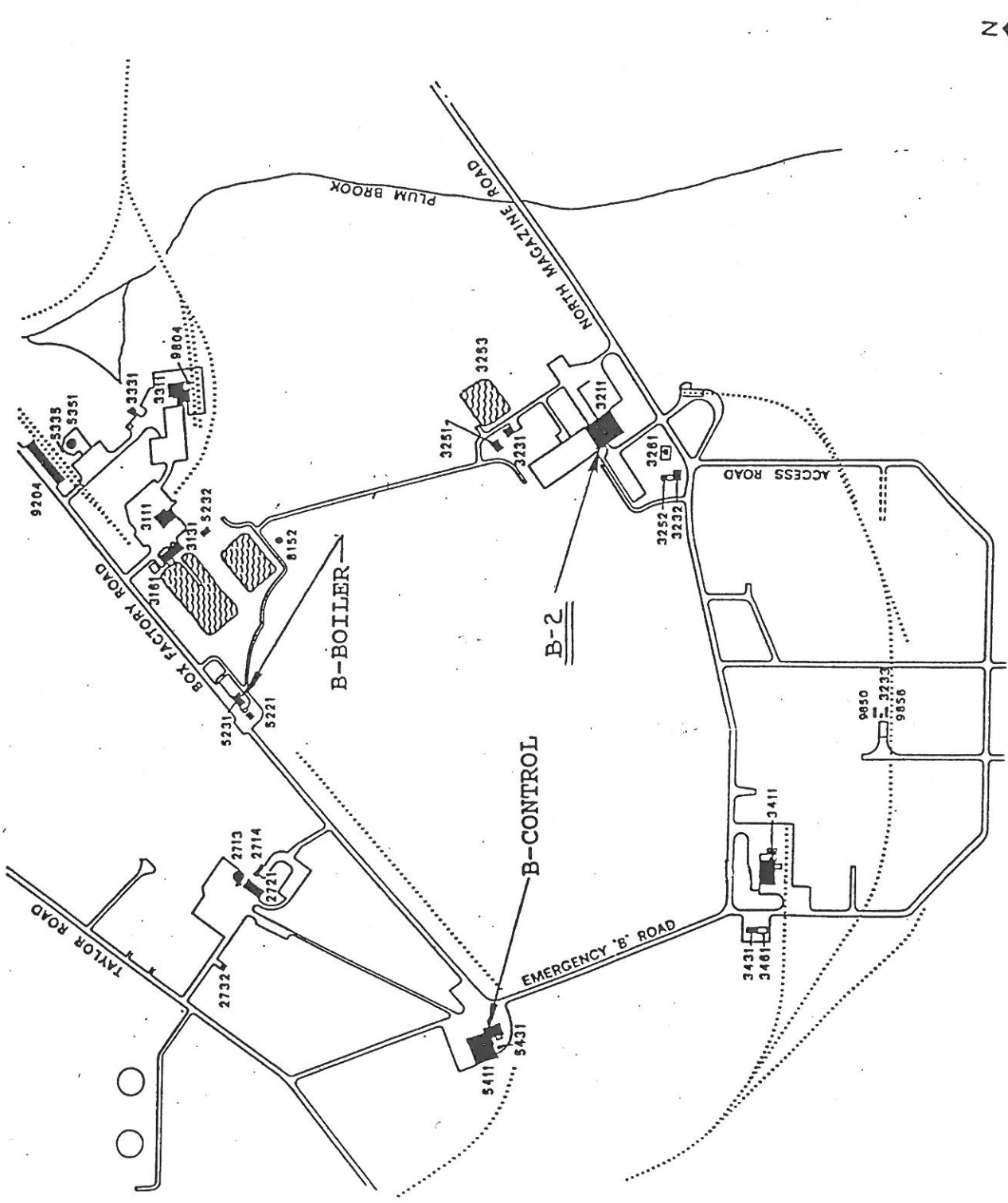


FIGURE 3



3000 SERIES KEY PLAN
ROCKET RESEARCH FACILITIES ORIENTED TO B CONTROL
FIGURE 4

significantly from the existing site in relation to parameters such as land resources, water resources, biotic resources, Flood plains, and wetlands. However, selection of an alternative location would not eliminate the need to perform basic maintenance of the existing B-2 facility.

IV ENVIRONMENTAL IMPACT OF ALTERNATIVES

A. Introduction

The organization of this section has been outlined in a format consistent with the NASA Lewis Research Center's Environmental Resources Document (Ref. 1). Specifically, the impact of the three alternatives described in Section III of this EA are compared and contrasted against the following parameters:

- Land Resources
- Air Resources
- Water Resources
- Noise
- Biotic Resources
- Flood plains and Wetlands
- Solid Waste
- Hazardous Substances and Hazardous Waste Management
- Historical, Archeological, and Cultural Factors
- Social and Economic Factors
- Utilities and Transportation
- Environmental Justice

B. Affected Environment

A brief description of the factors are presented below. Additional details can be found in the NASA LeRC Environmental Resources Document (Ref. 1).

Land Resources

The topography adjacent to B-2 is relatively flat with surface soils comprised of lacustrine clay, underlain by glacial till. The two major soil associations in the area of B-2 and related facilities are the 1) Prout-Prout and 2) Arkport-Galen soils. The underlying rock is of sedimentary origin and Devonian age, comprised primarily of limestone or shale.

Air Resources

Erie County has one Total Suspended Particulate Monitor operated by the Ohio EPA. The monitor shows that air quality is consistently in compliance with particulate standards. Due to the rural nature of Erie County, where PBS is located, all other parameters are also in compliance with the National Ambient Air Quality Standards. Erie County is classified as an attainment area for all air quality parameters (see Ref. 6).

The authority having jurisdiction for PBS air emission permits and regulation is the Ohio EPA Northwest District Office in Bowling Green, Ohio. The Ohio EPA has performed on-site inspections and issued air permits for operation of the boilers located in the B-Boiler building. As stated previously, these boilers are used for the production of steam to support

altitude simulation at B-2. The Ohio EPA will need to be notified if there will be any engine tests conducted in the B-2 facility utilizing fuels other than hydrogen and oxygen. These atypical tests would be expected to be of short duration, and to utilize only small amounts of fuel during each test run.

Water Resources

There are 13 streams which drain PBS. Some of these streams are relatively minor and originate on site. Ten of these streams receive only storm water. The three major streams, Plum Brook, Ransom Brook, and Kuebeler Ditch, receive discharges from permitted outfalls at PBS, as well as storm water. All of the streams drain to Lake Erie and all are classified as warm water habitat by Ohio EPA.

There are no groundwater withdrawal wells at PBS. All process water comes from Lake Erie. Potable water comes from the Sandusky Water Treatment facility which withdraws water from Lake Erie.

Noise

PBS is located in a mixed rural and suburban area. There is only one source of ambient noise external to the facility; traffic noise. The Ohio Turnpike runs east-west approximately 1.2 kilometers (3/4 mile) south of the facility. U.S. Route 250 parallels to the east side of the facility, often within a few hundred meters (yards) of the fence line.

Biotic Resources

Plum Brook Station provides support for a large and diverse biota. NASA utilizes the U.S. Department of Agriculture, Animal Damage Control Program, in cooperation with the Ohio Department of Natural Resources, Division of Wildlife, to manage the wildlife at PBS. The U.S. Department of Agriculture, Animal Damage Control Program, maintains offices at PBS which assist in the management of local wildlife.

A threatened and endangered species survey was performed at Plum Brook Station during the summer-fall of 1994 by the Ohio Department of Natural Resources. The surveyors identified several state threatened or endangered species on the facility, and a report on the survey was distributed to Plum Brook Station in 1995. The species included are listed on page 17.

Flood Plains and Wetlands

There are several wetland areas at Plum Brook Station. Due to the large acreage on which PBS is situated, wetlands are important to the ecology of the area. Most of these wetlands are in the central and south central portion of PBS. Though there has not been a survey of the wetlands, none have been identified in the vicinity of B-2.

Flood plains exist around each creek or brook on PBS. None of the buildings at PBS lie in the 500 year flood plain. Further information on PBS Flood plains can be obtained by consulting the Army Corps of Engineer's (Buffalo District) report prepared for PBS, entitled "Special Flood Hazard Evaluation Report for Plum Brook, Pipe Creek, and Tributary Streams in

Erie County, Ohio", dated April 1984. The activities at PBS, in general, contribute little, if any, to floods, as much of the rainfall percolates into the ground.

Solid Waste

Solid waste regulation on the federal level mainly deal with defining solid wastes and specifying criteria for the recycling and reuse of various materials. Solid wastes at PBS consist of office trash, scrap parts and equipment from test operations, construction, maintenance and demolition debris from building maintenance and other miscellaneous wastes. Plum Brook Station participates in the Lewis Research Center's recycling program.

Hazardous Substances and Hazardous Waste Management

Hazardous substances and hazardous waste are managed, handled, and disposed in accordance with environmental regulations. Hazardous substances used at PBS basically fall into 4 categories:

1. Materials used in research and development (laboratory chemicals).
2. Materials used in operations and testing (propellants, gasses, rocket fuels, alkalies).
3. Materials used in the construction, operation and maintenance of buildings, grounds and utilities (coatings, paints, herbicides, etc.)
4. Fuels used for heating and motor vehicles (gasoline, diesel fuels, heating oils, etc.)

Hazardous waste is accumulated at waste satellite accumulation areas. The wastes are usually used oil and spent solvents. Routine disposal of waste chemicals is managed by LeRC through a service contractor. Waste chemicals are temporarily (90 days or less) stored in Building 9206 until transported for proper permanent disposal.

Historical, Archeological, and Cultural Factors

Plum Brook Station is located on a site formerly occupied by the Plum Brook Ordnance Works, an area of approximately 9,000 acres, where TNT was manufactured during World War II. The installation was "mothballed" following the war until Lewis Research Center leased part of the land in 1956. By 1963, NASA acquired nearly 8,000 acres of what became known as Plum Brook Station (since the early 1960's approximately 1600 acres have been exsessed and sold off by the government). The additional land was obtained to support a number of rocket test facilities. In the early 1960's B-2 was constructed. It has since been declared a National Historic Landmark by the Department of Interior, due to its significance in the development of the space program.

Native Americans occupied much of Erie County during the prehistorical period. There are approximately 133 archeological sites of known historical significance lying outside the fence encircling the central area of Plum Brook Station that have been placed on the Ohio Historical Society Register.

Social and Economic Factors

At present, there are approximately ten NASA and 100 contractor employees who work at Plum Brook Station. Additional work is performed by project specific contractors and various federal agencies. Total site employment averages less than 150 people. A total of 30 people work at B-2.

Plum Brook Station, located in Erie County, is not included in a metropolitan area (by definition). Erie County is essentially rural with the city of Sandusky as its commercial center. The estimated population of Erie County in 1990 was 75,574 and projections show that the population will decrease by almost 5,000 by the year 2010. This decrease is primarily due to a decrease in employment opportunities in the local manufacturing industries.

Utilities and Transportation

Utilities

Most of the Plum Brook Station utilities are provided by municipal and industrial services. The exception is the raw water supply which is used primarily for fire protection and process requirements. Raw water is supplied by NASA owned and operated pumping facilities.

There is some electric power available from small generators within the site, but they are used only for emergency needs or in areas within the site where no outside source is readily available.

Natural gas, and to a lesser extent fuel oil, are used for heating and as a fuel source for boilers which support facility testing.

Plum Brook Station currently operates three small package wastewater treatment plants which receive the wastewater generated from remote on-site activities. The output of these plants passes through monitored outfalls operated under Ohio EPA NPDES permits. The main site wastewater treatment system, the Taylor Road Sewage Treatment Plant, was decommissioned in June 1995 following the tie in of the wastewater lines into the Erie County Sanitary System.

Transportation

Major vehicle transportation accesses to Plum Brook Station are the Ohio Turnpike on the South or Route 6 and 2 on the North. Both of these routes are bisected north-south by U.S. 250.

The amount of vehicular traffic generated by Plum Brook Station depends on the type and level of activity. An average amount of trips made into the facility is 400 trips per week with 30 of the trips being trucks. This traffic enters and exits onto Taylor Road. U.S. 250, the major access highway to Plum Brook Station, has congested traffic particularly during summer months, but the contribution of traffic from Plum Brook Station is very small. Public airports, railroads, and public transportation are not accessible at Plum Brook Station.

Environmental Justice

Environmental justice is a new environmental regulatory requirement. It requires federal agencies to make achieving environmental justice part of its mission. This is accomplished by identifying and addressing disproportionately high and adverse human health or environmental effects resulting from the agency's programs, policies, and activities on minority populations and low-income populations.

Plum Brook Station is located on 2,590 hectares (6,400 acres) which are fenced in from the nearby rural community. Minority populations and low-income populations are not an identifiable group within the radius of significant impacts resulting from the operation of this facility.

C. Environmental Impact

The following is an evaluation of the environmental impacts of each of the alternatives on the identified factors.

Land Resources

Land resources takes into consideration the physical features of the land, including the soils, local geology, and local seismology. The proposed action and alternatives are reviewed for land use and future management.

Operation of B-2

The proposed action is not expected to have a negative impact on this environmental parameter. Substantial site work is not required; i.e., large excavations, construction, or soil contouring. Previously operated facilities and equipment are being used and additional land for construction is not required. However, on occasion small excavations and trenching tasks may be required to install, repair, or replace site utilities. In these cases, minimal quantities of soil are disturbed. For larger tasks where soils are excavated, a soil analysis is performed to determine if the soil needs to be disposed as hazardous waste. The land adjacent to B-2 is grassed and maintained. Grounds maintenance is expected to have a positive impact by stabilizing the local soils and managing rainwater runoff.

No Operation

No environmental impact would result if the proposed action is not implemented. However, over time if B-2 and associated facilities are not maintained, the structures would eventually deteriorate. The results may lead to soil contamination from flaking paint, possible release of asbestos insulation, as well as reduced aesthetics due to lack of maintenance.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

Land used at a new site will likely be affected more negatively than land already dedicated to the existing facilities under the proposed action. Selection of an alternate site will require additional land resources and significant construction since a similar facility does not currently exist. The

proposed site uses land already dedicated for spacecraft propulsion testing. The facilities use approximately 80 hectares (200 acres).

Air Resources

Air resources take into consideration information regarding the surrounding area as it relates to attainment of National Ambient Air Quality Standards and air emissions sources result from operation of B-2.

Operation of B-2

The facility operation of B-2, without the use of a fuel propellant, results only in steam emissions generated from the process of pulling a vacuum in the test chamber. The steam is released from the facility through the steam ejector system. The Ohio EPA has been advised of operational testing and the resulting generation of steam and is not concerned about the steam release. The released steam, which forms a mushroom-like cloud, is not easily observed by near-by residences due to the facility's distance from residential homes and as a result of the natural dissipation of the steam.

It is possible that some of the engine testing conducted at the B-2 facility will utilize fuels other than hydrogen and oxygen, in small amounts and for short test run durations. An example of such a fuel would be hydrazine. It is anticipated that there will be very little air emissions generated from the burning of these fuels during testing. Additionally, any minor amounts of emissions generated will be virtually undetectable, when combined with the significant amounts of steam emitted at the same time. The Ohio EPA will need to be made aware of the intent to conduct these fuel burning engine tests, but it is not expected that a permit will be required.

No Operation

If the proposed action is not implemented, there would not be a steam release to the environment. Therefore, there would be no environmental impact.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

Potential air emission concerns during operations at an alternate site would be the same as those described above for fuels burning at the B-2 facility. There would be some additional air sources resulting from the actual construction process.

Since the generation of steam is not an air emissions concern, the environmental impact to be considered is the observance of generated steam. If the B-2 type operations were located in a publicly-accessible area the generation of steam may create a public-nuisance disturbance. If the B-2 operations were located in a remote location, similar to its current location, there would be no environmental impact.

Water Resources

Water resources take into consideration surface water bodies and groundwater which may be effected by this project. The current status of effected water bodies is also briefly discussed.

Operation of B-2

The operation of B-2 results in water discharges from five sources:

1. Three sump pumps which collect surface water (rain) which enters the building through the ramp area.
2. Three sub-surface sumps discharge groundwater from the floor drains.
3. The spray chamber
4. Blowdown discharges from two cooling towers and one heating boiler.
5. The Boiler Building (Bldg. 5231) blowdown discharge.

Sources 1 and 2 are sumps which collect groundwater and rainwater which enter the building and pump it to surface water ditches. They will be present whether or not the facility is operating.

All water is discharged into ditches surrounding the facility, which eventually flow into either Plum Brook or Ransom Brook. Both of these brooks are monitored by on-site personnel in accordance with the Ohio EPA National Pollutant Discharge Elimination System (NPDES) Permit.

Source number 3 is water from the spray chamber, which is originally supplied to the chamber by the site process water system (pumped from Lake Erie). Since the total chamber capacity is 6.6 million liters (1.75 million gallons) the chamber is only infrequently pumped out. When it is the water is routed to a 7.6 million liter (2 million gallon) holding pond. Once it has been sampled and found to be within the limits of the site NPDES Permit the water may be pumped at a slow rate into a surface ditch.

Water used in cooling towers and boilers (sources 4 and 5) is treated during use, and water discharged from these sources will contain residual treatment chemicals. An application seeking approval from the Ohio EPA to use the chemicals has been submitted to the EPA by the on-site Environmental Office. The Ohio EPA is aware of these four treated water discharge sources and has granted approval of the discharges via the existing NPDES Permit.

The Boiler Building (Bldg. 5231) supplies steam to the B-2 ejector train, and has a continuous blowdown rate of a few gallons per hour when the boilers are running. During normal operations, the boilers are blowdown at most twice per day, generating approximately 3000 liters (800 gallons) of waste boiler water. This blowdown water is discharged to a ditch behind the Boiler Building. Groundwater is not affected by B-2 operational activities

No Operation

If the proposed action is not implemented three water sources would continue to discharge, those being the three surface water sump pumps, the three sub-surface sumps which discharge groundwater from the floor drains, and blowdown water from the heating boiler. Ransom Brook and Plum Brook receive water from other on-site sources, therefore would not dry-up if B-2 were not operated. Therefore, a lack of operational activities would have minimal, if any, impact on water resources.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

The duplication of the B-2 operation at an alternate site would require the construction of a similar facility. The construction may adversely impact water bodies, dependent upon the location of the facility and manner of construction. Direct operations, under the same conditions, would also create little, if any, environmental impact.

Noise

Noise takes into consideration the noise (sound level, dB(A)) resulting from the operation of B-2 under test conditions. The proposed action and alternates are reviewed for both worker exposure and community exposure.

Operation of B-2

The proposed action is not expected to have a negative impact on the community or on Plum Brook Station employees in respect to this environmental parameter. The source of noise at B-2 is the operation of the steam ejector system. Effects on the community noise environment during operation of the B-2 facility are expected to be below $L_{dn} = 55$, which is typical of the quietest residential neighborhoods. Measurements of the actual noise levels will be taken once operations begin. Should noise levels prove to be higher than expected, mitigation measures will be instituted as required.

No Operation

If the proposed action is not implemented, there would be no adverse environmental impact on the surrounding community or Plum Brook Station employees since no noise would be created.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

Due to the uniqueness of the present location of B-2 on the 2,590 hectare (6,400 acre) Plum Brook Station, it is very likely that the environmental impact caused by noise would be greater at another location. The large amount of land and space that separates the present facility from the community would not likely be found elsewhere due to the widespread development of industry and communities.

Biotic Resources

Biotic resources take into consideration all protected species of flora and fauna known to inhabit the area or which may be otherwise affected by the proposed actions and alternatives. As previously noted, a Threatened and Endangered Species Survey was performed for Plum Brook Station in 1994, and a final report produced in 1995. Several state threatened or endangered species were identified at Plum Brook Station.

State-listed species found at the NASA PBS in 1994 included:

Endangered

Least St. John's-wort, *Hypericum Gymnanthum*
sedge wren, *Cistothorus platensis*
thin-leaf sedge, *Carex cephaloidea*

Threatened

grove sandwort, *Arenaria laterifolia*
field sedge, *Carex conoidea*
ashy sunflower, *Helianthus mollis*
upland sandpiper, *Bartramia longicauda*

Potentially Threatened (plants)

prarie false indigo, *Baptisia lactea*
broad-winged sedge, *Cares alata*
round-fruited hedge-hyssop, *Gratiola virginiana*
Tall St. John's-wort, *Hypericum majus*
Virginia meadow-beauty, *Rhexia virfiniana*
lance-leaved violet, *Viola lanceolata*

Operation of B-2

Results from the Endangered and Threatened Species Survey indicate that a State threatened species of violet was identified living in the vicinity of the as part of B-2 Boiler Building (Bldg. 5231), but the proposed operation of the facility will not have an adverse impact on this protected species. It is believed that given the short and infrequent nature of the testing the noise from the steam ejectors will have no adverse affect on the area fauna.

Additionally, no landscaping or reforestation is planned as part of B-2 operation, and therefore would pose no impact.

No Operation

If the proposed action is not implemented, there would still not be an environmental impact.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

Since NASA follows state and federal regulations, the selection of a site for constructing a new facility would take into consideration the location of endangered and threatened species. Actions would be implemented to ensure minimal impact to these species.

Flood Plains and Wetlands

Any activities which would take place in a floodplain, or would effect a wetland, are described. The connection of a floodplain or wetland to other water bodies is also identified and evaluated.

Operation of B-2

As previously indicated, most of the wetlands on PBS are located in the central and south central portion of PBS. The B-2 facility is situated on the western portion of the station. Although a wetlands survey has not been performed on PBS, no potential wetlands have been identified near the facility.

B-2 is not located in a 500 year flood plain and activities from the operation of the facility would not result in contributing to floods.

No Operation

If the proposed action of "No Operation" were chosen, there would continue to be no impact upon flood plains and wetlands.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

If duplication of B-2 operations were to be performed at an alternate site, there may be an impact upon flood plains or wetlands dependent upon construction activities and the location of the site.

Solid Waste

Solid waste management takes into consideration the solid waste stream generated as a result of each conditional status. Waste streams considered in this section include office waste, scrap parts and equipment from test operations, construction, maintenance and demolition debris from building maintenance and other miscellaneous wastes. Hazardous waste streams are evaluated under the section titled "Hazardous Substances and Hazardous Waste Management".

Operation of B-2

The operation of B-2 is not expected to have a negative impact on this environmental parameter. The facility operation will only produce solid waste such as trash, which is disposed of in a state licensed landfill, and scrap materials which are either disposed in a state licensed landfill or recycled if a recycling program is available.

No Operation

The proposed action of no operation will not have an impact on this environmental parameter. The number of people required to operate the facility is small, thereby producing small amounts of solid waste. Thus the amount of solid waste would not be substantially decreased since the normal operations of the facility do not produce a large quantity of solid waste.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

If B-2 operations were to be duplicated at an alternate site there may be an environmental impact, especially if the alternate site would have to be built. Construction activities would produce a substantially increased quantity of solid debris.

Hazardous Substance and Hazardous Waste Management

The use of hazardous substances and the generation of hazardous waste are evaluated for each alternative. Hazardous substances utilized at B-2 consist primarily of solvents, paints, welding gases, and oxygen, hydrogen, and nitrogen for testing conditions. Hazardous waste generated consists primarily of waste solvents.

Operation of B-2

Chemicals are purchased and used at the facility on an as-needed basis. Chemicals are not permitted to be "stock-piled". Employees are trained in the proper handling, usage, and disposal methods in accordance with EPA and OSHA hazardous substances and waste regulations. Additionally, the fuels used for some of the engine testing, will likewise be purchased on an as-needed basis, and are expected to be used in totality during the tests (ie. no left over fuels). Because of the engine testing process, all fuels are expected to be burned, and no wastes will be generated from the process.

The operation of B-2 may infrequently produce discrete large quantities of waste chemicals. As an example, several hundred liters of used solvent might result from a large scale maintenance and cleaning effort at the facility. The disposal of the chemicals will be coordinated through the Lewis Research Center's Office of Environmental Programs. Normal operation of the facility will produce minute quantities of waste solvent, which will be placed in the waste solvent drum located at the facility. Disposal of the waste solvent drum is additionally coordinated through the Lewis Research Center's Office of Environmental Programs.

No Operation

If the proposed action of "No Operation" were chosen, smaller amounts of hazardous substances would be used at the facility. As a result, less hazardous waste would be generated at the facility. Therefore if this option were chosen the environmental impact would be less than if the facility were in operation.

Duplication of the B-2 Operations at an Alternate (Unspecified) Site

If the B-2 operations were to be performed at an alternate site, the necessity of construction would require the use of minor quantities of hazardous substances and could possibly result in the generation of minor amounts of hazardous waste. The resulting hazardous waste disposal would have a greater impact on the environment than if operations were to commence at B-2.

Historical, Archeological, and Cultural Factors

Any historic or archaeological resources which may be effected are evaluated under the differing alternatives in this section.

Operation of B-2

Archaeological sites of known historical significance are located outside the Plum Brook Station parameter. Therefore, it is likely that there are archeological significant areas within PBS. However, since the B-2 facility is already constructed, the operation of B-2 will not have an impact on these sites.

The Spacecraft Propulsion Research Facility (B2) has been declared a National Historic Landmark, and keeping the facility operational and fully maintained is the best way of preserving it, since the constant presence of workers will insure that minor facility problems, such as roof leaks, are noticed and repaired quickly.

No Operation

If this option were selected, there would not be an effect on any archeological sites at PBS, but there would be a negative impact on B-2, a National Historic Landmark, since the upkeep and maintenance of a mothballed facility is more of a burden than the similar care of a functioning, constantly staffed facility.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

Since NASA follows state and federal regulations, the selection of a site for constructing a new facility would take into consideration the location of historical or archaeological significant sites. Activities would be implemented in such a way as to ensure minimal impact historical resources; therefore, the environmental impact at the alternate site should remain at a minimum level. There would still be a negative impact at B-2 since as with the No Operation option this would result in the maintenance and upkeep of B-2, a National Historic Landmark, being less timely than with a constantly staffed facility.

Social and Economic Factors

This section takes into consideration the potential impacts on the social and economic character of the area surrounding Plum Brook Station under the facility operational conditions identified. A description of the social and economic character of the area was previously provided in the Section titled "Environmental Impact of Alternatives", page 12.

Operation of B-2

The proposed action is not expected to have any kind of impact on this environmental parameter. Most purchases of maintenance items and/or equipment repair or refurbishment that can be expected would not be procured locally due to the uniqueness of the facility and equipment. The number of people employed to run this facility is low and they are moved

from one test site to another at Plum Brook Station as needed to meet facility testing requirements. Personnel are not hired just to operate B-2 so the social and economic factors associated with the employment of personnel at B-2 are minimal.

No Operation

If the proposed action of "No Operation" were chosen, there would not be a social and economic impact on the surrounding communities. The small number of people who operate the facility would be reassigned to another facility. Since most purchases and equipment repair would not be procured locally, a negative social and economic impact would not be felt in the surrounding communities.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

If the B-2 operations were to be duplicated at an alternate site, there may be an impact on the social and economic factors surrounding the alternate site. This is due to the amount of work to be performed and material and equipment that would have to be purchased to build a facility such as B-2.

Utilities and Transportation

This section describes the surrounding utilities and transportation services which are available for the operation of B-2. Evaluated under utilities are water, wastewater systems, and power sources. Evaluated under transportation are major vehicular access roads and local airports, railroads, and public transportation.

Operation of B-2

The proposed action is not expected to have any kind of impact on this environmental parameter. All utilities already exist (water, sanitary systems, and power substations); therefore, new utility sources would not have to be built. The facility does not consume massive quantities of electric power or water where it would affect the surrounding communities. There will be no hindrance to the public-accessible transportation system, and transportation activities required to operate the facility will not impact the community since only a few deliveries will be made in support of the operations.

No Operation

If the proposed action of "No Operation" were chosen, there would not be a need to supply and consume utilities that are used at the facility. Vehicular traffic impact on the community would not be affected since there is little impact when the facility is in operation.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

If the B-2 operations were to be duplicated at an alternate site, there may be an environmental impact on utilities and transportation dependent if new utilities (water, power, and sanitary systems) and access to major roadways would have to be designed and built to support a facility like B-2.

Environmental Justice

Federal agencies are required to make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects resulting from the agency's programs, policies, and activities on minority populations and low-income populations.

Operation of B-2

The proposed action is not expected to have an impact on this environmental parameter. The facility is located on 2,590 hectares (6,400 acres) which are fenced in from the nearby rural community. NASA specifically decided to locate the Plum Brook Station facilities on an area large enough to ensure that the research activities conducted have a minimum impact to the near-by rural community, of which minority populations and low-income populations are not a significant proportion.

No Operation

Since minority populations and low-income populations are not a significant proportion near the facility, the non-existence of an impact to these types of communities is the same whether the facility is in operation or not.

Duplication of B-2 Operations at an Alternate (Unspecified) Site

In accordance with regulatory requirements, if NASA were to construct another facility which could duplicate B-2 operations, NASA would need to ensure that there would not be a disproportionately high and adverse human health or environmental effect on minority populations and low-income populations. Therefore the impact would remain at the same minimal level.

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