

United States General Accounting Office

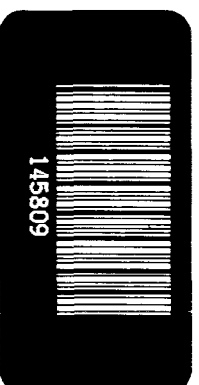
GAO

Report to the Chair, Subcommittee on
Government Activities and Transportation,
Committee on Government Operations,
House of Representatives

February 1992

ENVIRONMENTAL PROTECTION

Rocket Tests in Mississippi to Be Heavily Restricted





United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-247007

February 7, 1992

The Honorable Barbara Boxer
Chair, Subcommittee on Government
Activities and Transportation
Committee on Government Operations
House of Representatives

Dear Madam Chair:

As you requested, we identified environmental issues related to the testing of the Advanced Solid Rocket Motor (ASRM) at the Stennis Space Center in Mississippi. You also asked us to identify the environmental effects of shuttle launches on and near the Kennedy Space Center and to follow up on the National Aeronautics and Space Administration's (NASA) implementation of our earlier recommendations.¹

Background

Since the beginning of the space shuttle program, a NASA contractor has manufactured and tested shuttle solid rocket motors in contractor-owned and-operated facilities in Utah. Following the Challenger accident in 1986, NASA studied ways to improve the safety and effectiveness of the space shuttle program. It concluded that it needed to develop an improved solid rocket motor.

In October 1987, Congress authorized NASA to develop an ASRM. NASA's studies concluded that modern production facilities could improve manufacturing quality of the ASRM and that government-owned, contractor-operated facilities would provide increased opportunities to compete future requirements. In April 1989, NASA selected an abandoned nuclear power plant site at Yellow Creek, Mississippi, for ASRM production and the Stennis Space Center in Hancock County, Mississippi, for ASRM testing.

NASA plans to conduct seven ASRM ground tests, each burning 1.2 million pounds of propellant in 2 minutes and 15 seconds, from October 1994 to January 1997. It also plans to conduct two tests annually for the remainder of the program. NASA's current solid rocket motor production and testing program in Utah will continue until the ASRM becomes available for flight.

¹Environmental Protection: Solving NASA'S Current Problems Requires Agencywide Emphasis (GAO/NSIAD-91-146, Apr. 5, 1991).

Results in Brief

NASA used computer modeling to predict that ground level exhaust pollutants from ASRM tests will fall within acceptable air quality limits and will have insignificant environmental impacts. Data from some ground level tests in Utah of the current solid rocket motor were used to support model predictions. Federal and state regulators examined the computer modeling and concluded that it provided reasonable assurance that exhaust pollutant concentrations will be insignificant. They also decided to provide additional assurances by (1) requiring extensive monitoring of tests and (2) placing a variety of conditions and restrictions on tests.

During our review, NASA decided to add upper level air sampling to its ground level sampling of current solid rocket motor tests to help determine the accuracy of its estimates of exhaust products and particle sizes. Such estimates are essential inputs to predictive computer models. The results of the upper level air sampling should provide useful data to refine and improve the predictions of the environmental effects of ASRM tests.

Reacting to concerns of the Army Corps of Engineers and others, NASA redesigned its ASRM test facilities at Stennis to reduce wetlands impact. NASA has also agreed to restore former wetlands currently forested in pine trees to their original condition.

NASA has monitored and evaluated shuttle launches since they began in 1981. These evaluations indicate that the eventual planned shuttle launch rate of up to 10 per year will cause insignificant environmental damage on and near the Kennedy Space Center. Only temporary damage to vegetation and the killing of small fish in the immediate launch area is expected to result.

NASA has been working to improve its overall environmental management program since our April 1991 report. It increased the size of its headquarters and field center environmental staffs and, according to NASA's current environmental program manager, plans to implement all of our recommendations within the next 12 to 18 months.

Due to environmental problems and the extent of cleanup requirements, as many as five NASA facilities may contain hazardous waste sites that are among those most threatening to public health and the environment. NASA and Environmental Protection Agency (EPA) officials believe that these sites may be designated as Superfund sites.

Citizen Groups Are Concerned About ASRM Testing in Mississippi

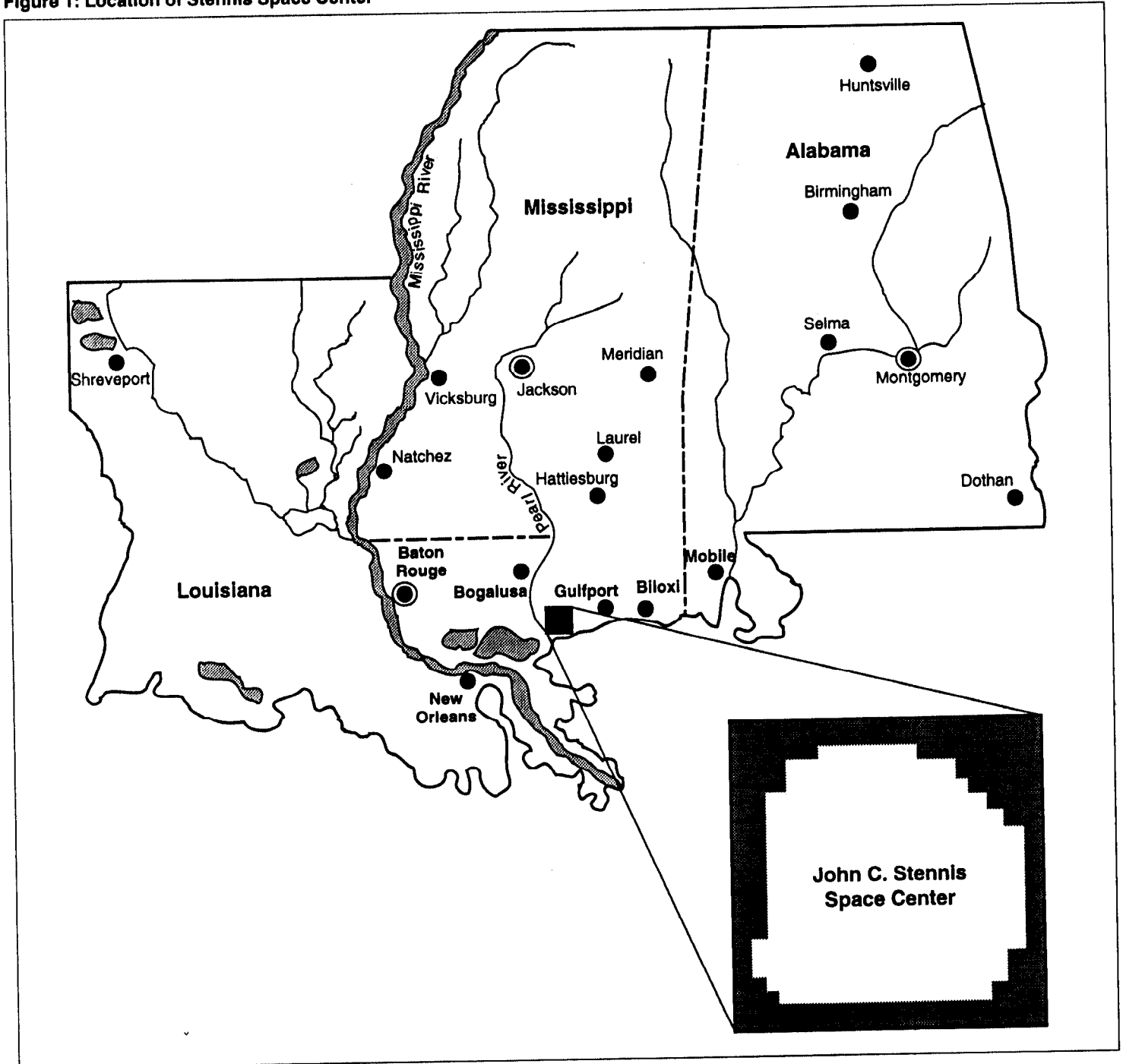
Groups representing people living near the Stennis Space Center have contested NASA's decision to test the ASRM in Mississippi because of their concerns about potential environmental consequences. They are concerned that NASA's computer modeling of ASRM tests cannot accurately predict these environmental effects and that environmental data on testing in Utah is not relevant for predicting environmental damage in Mississippi. The groups believe that the vastly different climatic and meteorological conditions in Mississippi will cause more damage to the environment. They contend that Mississippi weather, with its high relative humidity and frequent rainfall, increases the possibility that exhaust pollutants will create acid rain and aluminum oxide fallout on the land surrounding the test site. They also contend that, over time, the buildup of pollutants may upset the natural chemical balance in the area's soil and water and affect plants and wildlife. The general location of the Stennis Space Center is shown in figure 1.

Citizens have also complained that the ASRM test site planned for Stennis will destroy protected wetlands, thus violating the President's national goal of "no net loss" of wetlands.

A final issue raised by some people is that increases in aluminum oxide in the atmosphere caused by ASRM testing may increase the chances of acquiring Alzheimer's disease. Recent epidemiological studies by medical experts indicate that exposure to aluminum particles in the environment appears to increase the chance of developing Alzheimer's disease.

These concerns have resulted in three court actions contesting NASA's plans to test the rockets in Mississippi. The suits contend that NASA did not (1) adequately consider other locations for ASRM testing that are more environmentally suitable than Stennis, (2) adequately address environmental effects of testing on air and soil, and (3) plan to avoid destruction of wetlands.

Figure 1: Location of Stennis Space Center



NASA's Selection of Stennis for ASRM Testing

NASA's search for suitable sites to produce and test the ASRM began in August 1987, when NASA awarded conceptual design and study contracts to all major solid rocket manufacturers in the United States. These studies identified six sites for further study—Kennedy Space Center in Florida; Stennis Space Center in Mississippi; Vandenberg Air Force Base in California; an abandoned Tennessee Valley Authority nuclear power plant site in Yellow Creek, Mississippi; and two contractor-proposed private sites in Promontory, Utah, and Montgomery, Alabama. The last two sites were subsequently withdrawn from consideration by the contractors. Also, NASA officials eliminated Vandenberg Air Force Base because they believed that transporting the rocket segments by water through the politically sensitive Panama Canal or by rail across the country would entail unacceptable risks.

In June 1988, the NASA site evaluation board recommended the Yellow Creek site in Mississippi for manufacturing the rocket and the Kennedy Space Center in Florida for testing. The team recommended Kennedy for ASRM testing because the existing space shuttle infrastructure could be used, and the rocket exhaust could be aimed out to sea, thus causing fewer environmental problems. In July 1988, after consulting with the Air Force, with which it shares launch facilities, NASA's site selection official decided against Kennedy because the Air Force planned to use the proposed ASRM test site for launch activities. Instead, the selection official tentatively selected the Yellow Creek site in Mississippi for production and Stennis Space Center for testing, pending completion of an environmental impact statement. In August 1988, NASA issued the request for proposal for ASRM development and production, listing these two sites as the basis for all proposals.

In March 1989, NASA published its final environmental impact statement for the ASRM program. It concluded that ASRM testing would not result in significant environmental damage at either the Kennedy or Stennis sites. In April 1989, NASA officially announced its selection of the Yellow Creek site for rocket production and the Stennis Space Center for testing.

ASRM Test Restrictions and Monitoring

EPA and Mississippi state environmental regulators believe that adverse environmental effects should be precluded by the testing conditions and restrictions and monitoring requirements placed on NASA. The state and the Army Corps of Engineers also believe that NASA's revised facility construction plans and other agreements specified in NASA's wetlands permit will create more productive wetlands than currently exist. Further,

a medical expert who reviewed projections of ASRM test effects on human health for NASA concluded that, based on the agency's projections of aluminum particle concentrations, testing at Stennis should not increase citizens' chances of contracting Alzheimer's disease.

Review and Approval of Testing Plan

NASA relied on computer modeling to predict that ground level concentrations of hydrogen chloride and other exhaust pollutants from ASRM tests will not exceed acceptable EPA air quality limits and will have insignificant impacts on human health and the environment. State and federal regulators reviewed NASA'S computer modeling, which considers variables such as humidity and other meteorological conditions. As a result, they are satisfied that the environmental effects of ASRM testing in Mississippi should be insignificant. To provide further assurance, however, the state imposed a number of restrictions on ASRM tests.

NASA submitted the required application for a prevention of significant deterioration permit to state and federal regulators in August 1989. The application included details of the ASRM test plan and the computer models used to predict the environmental effects of ASRM testing. The permit was issued in December 1990, with requirements that NASA (1) restrict tests under unfavorable conditions and (2) conduct extensive monitoring of tests. Specific provisions of the permit are listed in appendix I. Also, according to state and NASA officials, NASA has agreed to fund an independent monitoring program to be conducted by state personnel.

According to state officials, after construction of the test facility, the state plans to issue NASA a performance evaluation permit to conduct its first ASRM test. Following a successful state evaluation of test effects, the state plans to issue a 3- to 5-year operating permit for additional tests. If any permit conditions are violated, or if tests result in adverse effects on plant or animal life beyond the boundaries of the Stennis Space Center, NASA cannot conduct another test until state officials review and approve the conditions for it.

Mississippi pollution control and EPA officials expressed confidence that tests conducted under the permit restrictions will not significantly affect air quality. They are also confident that rocket exhaust emissions will be widely dispersed in the atmosphere and will not significantly affect the area's soil and ground water. Finally, these officials believe that monitoring will ensure that NASA complies with testing restrictions and will detect any adverse environmental effects.

Additional Environmental Tests

To verify that its computer modeling accurately predicts concentrations of rocket exhaust products, NASA contracted for studies beginning in August 1988 to gather ground level air quality data during solid rocket motor tests in Utah. Prior to these studies, only limited environmental monitoring data was available. A NASA contractor has since sampled ground level air quality during seven tests. Tentative results suggest that actual sample concentrations of exhaust products tend to be lower than NASA model predictions.

During our review, NASA scientists decided to also conduct upper level air sampling tests in Utah to help determine if computer model predictions of exhaust product chemical composition and particle sizes are accurate. It is important to measure particle sizes because exhaust products that are 10 microns² and smaller tend to be widely dispersed by wind.

Actions to Prevent Loss of Wetlands

NASA'S final environmental impact statement on the ASRM program did not address the effects of constructing test facilities at Stennis on protected wetlands, which consist primarily of pine forests. In commenting on the impact statement, the Army Corps of Engineers stated that planned facility construction would cause a loss of existing wetlands. The Corps required NASA to obtain a wetlands permit pursuant to section 404 of the Clean Water Act and recommended that NASA issue a supplemental impact statement addressing wetlands issues.

In complying with Corps requirements for the wetlands permit, NASA changed its construction plans and reduced the wetlands areas to be destroyed from 80 to 68 acres. Additionally, NASA prepared a mitigation plan to restore 132 acres of other land by blocking man-made drainage ditches and planting hardwood trees in pine forests, thus allowing the land to revert to its original bottomland hardwood conditions. State and federal regulators believe that such actions will create more productive wetlands than currently exist. After reviewing NASA'S wetlands mitigation plan, the Corps granted a permit allowing NASA to construct the test facility. Also, NASA issued a supplemental final environmental impact statement addressing these plans.

²A micron is a unit of length equal to one millionth of a meter.

Risks of Alzheimer's Disease

Medical researchers have said that aluminum particles in the environment may increase human risk of contracting Alzheimer's Disease, and their investigations of this risk is continuing. NASA provided a medical expert with its projections that ASRM tests would result in concentrations of aluminum oxide particles that would not exceed EPA air quality standards. That medical expert concluded that local citizens' chances of contracting Alzheimer's disease will be insignificant if aluminum oxide particles released during ASRM tests are within NASA'S projections. NASA included this expert's statement in its supplemental environmental impact statement and in videotaped presentations at two public meetings.

Environmental Effects on Shuttle Launch Area

NASA environmental monitoring has shown that, at their eventual planned rate of up to about 10 per year, shuttle launches will cause temporary damage to vegetation and kill small fish in the immediate area of the shuttle launch facility at Kennedy Space Center. NASA monitoring of environmental effects since the first shuttle launch in 1981 has shown insignificant damage outside the immediate launch area along the Eastern Florida coast.

During a shuttle launch, an exhaust cloud forms whose major components are aluminum oxide, hydrogen chloride, carbon dioxide, and water vapor. The cloud forms when the boosters and main engines ignite and several thousand gallons of sound suppression and cooling water are simultaneously dumped onto the launch pad. In the turbulence of the rocket exhaust, hydrogen chloride (a known toxin) and water combine chemically to create a strong hydrochloric acid solution.

At liftoff, a trench around the launch pad directs the exhaust cloud away from the pad. Generally, within about .6 miles the cloud begins to rise as its horizontal speed decreases, and the prevailing winds disperse it. Another exhaust cloud follows the shuttle as it ascends, which is also eventually dispersed by prevailing winds.

The ground cloud sweeps across ground vegetation and nearby lagoons, producing acute environmental effects in the "near field" area. Kennedy Space Center scientists define the near field as an area within about .6 miles of the launch pad. The droplets in the cloud are extremely acidic and cause severe damage, including temporary vegetation damage. Also, the sudden acid shock kills small fish in nearby lagoons by the hundreds, but scientists do not consider this loss significant to area ecology. The dead fish are quickly devoured by native birds.

Vegetation changes in the near field area include loss of sensitive plant species, loss of plant community structure, reduction in total cover, and replacement of some species by weeds. The hardier grassland and tropical vegetation turn brown and are defoliated but tend to recover within weeks. During our visit to the launch site, about 2 weeks after the August 1991 launch, the grass was returning to its natural green color and some vegetation was sprouting new leaves. Kennedy scientists suspect that more frequent launches spaced a few weeks apart may kill the vegetation within about .6 miles of the pad.

The rising exhaust cloud, moving with prevailing winds, produces "far field" effects. Ground deposits from this cloud occur as acid spotting and aluminum dusting on vegetation and structures. NASA scientists have detected minor deposits up to about 14 miles from the launch site, but in concentrations significantly below levels considered dangerous by federal and state environmental regulations. Florida environmental regulators do not monitor environmental effects of launches because they do not consider them to pose significant environmental threats to Florida residents and property. They believe that NASA'S monitoring program is adequate. In addition, they believe the deposits affect the plants and structures only cosmetically and concur with NASA that the far field deposits are within allowable limits.

NASA'S Implementation of April 1991 Recommendations

In our April 1991 report we noted that, in carrying out its scientific research and development mission, NASA generates, stores, and disposes of tons of hazardous waste, including solvents, acids, and heavy metals. We pointed out NASA'S responsibility for complying with federal, state, and local environmental standards. However, we concluded that NASA had not adequately carried out its policy to prevent, control, and abate environmental pollution. For a variety of reasons, the total cost of NASA'S environmental compliance and restoration activities were unknown, and we recommended actions designed primarily to strengthen headquarters' oversight and management. Specifically, we recommended that NASA establish an agencywide implementation strategy, identify funding requirements for that strategy, and conduct periodic audits of compliance with federal, state, and local environmental requirements.

According to NASA'S current environmental program manager, NASA will implement our recommendations within the next 12 to 18 months. So far, NASA has added environmental staff positions both at headquarters and the field centers. Staffing has more than doubled for NASA headquarters and at

least four centers since we began our initial review in July 1990. In addition, NASA plans to develop a general environmental monitoring and compliance strategy that includes (1) determining appropriate staffing levels and qualifications for center environmental office staffs, (2) developing a system to monitor and track environmental problems, (3) developing a detailed strategy for disseminating information about problems encountered at one center to other centers that might encounter similar problems, and (4) planning more frequent environmental audits.

During our current review, we found that NASA plans to primarily use contractors to conduct its environmental audits. Such audits can help identify potential problems before they require cleanup and enforcement action. NASA believes that a single contractor can best provide the consistency needed across all the centers, provide necessary expertise, and write reports. We recommended in our April 1991 report that NASA'S environmental audits should be conducted primarily by teams of NASA headquarters and field center environmental specialists. Such experts would bring to the teams a comprehensive working knowledge of agency operations, have a personal interest in ensuring that the agency aggressively pursues proper environmental management, and help to disseminate information about environmental problems and solutions among centers. In October 1991, NASA decided to assign NASA employees to the contractor's audit team to ensure that these objectives will be achieved.

Some NASA Locations Are Likely Superfund Sites

In our April 1991 report, we noted that NASA had many studies underway to identify environmental problems and the extent of cleanup required, which would continue for several years. From these studies, EPA and NASA environmental managers believe that, for the first time, some NASA facilities may be added to the national priorities list—EPA's listing of the most hazardous waste sites (Superfund sites). EPA and NASA officials told us that the Jet Propulsion Laboratory in California and the Wallops Flight Facility in Virginia are likely to be listed as Superfund sites within a year. Three other facilities—Langley Research Center in Virginia and Ames Research Center and Santa Susanna Field Laboratory in California—may also be included on the list when ongoing evaluations have been completed. A description of the suspected environmental problems at these NASA facilities and a list of NASA facilities on EPA's federal facilities docket (federal facilities with potential as hazardous waste sites) are in appendix II.

Scope and Methodology

To obtain information on environmental issues related to ASRM testing and shuttle launches, we visited NASA headquarters; Kennedy Space Center, Florida; Langley Research Center, Virginia; Marshall Space Flight Center, Alabama; Stennis Space Center, Mississippi; the Mississippi Bureau of Pollution Control in Jackson, Mississippi; the Army Corps of Engineers in Vicksburg, Mississippi; and a member of the Mississippi Pollution Control Board in Biloxi, Mississippi. We also had discussions with officials of the EPA; Florida Department of Environmental Regulation; Utah Division of Environmental Health; Thiokol, Inc.; and other knowledgeable people to obtain their comments on the subject environmental issues. We also discussed these issues with representatives of a concerned citizens' organization in Mississippi and with the Council on Environmental Quality in Washington, D.C.

As agreed, we did not address the atmospheric effects of solid rocket motor fuel use. Such effects are being addressed in our ongoing review of the ASRM program, which is being done at your request.

We interviewed NASA headquarters environmental officials and program office analysts on the extent to which NASA had carried out our prior report's recommendations and obtained available documentation regarding NASA's efforts. We also contacted NASA field centers to discuss changes in their environmental programs and to obtain additional documentation.

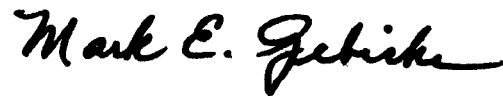
We conducted our review from July 1991 to January 1992 in accordance with generally accepted government auditing standards.

As requested, we did not obtain NASA's comments on this report, but we obtained the views of responsible NASA officials and considered them in preparing this report.

We are sending copies of this report to the Administrator, NASA; appropriate congressional committees, and other interested parties upon request.

If you have any questions, please call me on (202) 275-5140. Other major contributors are listed in appendix III.

Sincerely yours,



Mark E. Gebicke
Director, NASA Issues

State of Mississippi Conditions and Restrictions on ASRM Testing at Stennis Space Center

The state of Mississippi's "Prevention of Significant Deterioration Permit" for the ASRM testing site at Stennis Space Center requires that NASA:

- Obtain from the National Weather Service a certified forecast that no rain is predicted within 20 miles of the test site during the 4-hour period immediately following a test. Testing is restricted to periods when weather conditions specified in the permit exist. Such conditions are intended to achieve wide atmospheric dispersion of exhaust products.
- Establish a meteorological support station at the center within 12 months after permit issuance—by December 1991. The station is to develop site-specific atmospheric profiles to more accurately predict exhaust cloud behavior and dispersion.
- Measure the actual exhaust cloud rise and path for each test and compare to predicted results.
- Not conduct tests during nighttime hours, defined as 1 hour before sunset until 1 hour after sunrise, and not conduct tests solely for disposing of solid rocket motors.
- Obtain state approval of a detailed test sampling plan to determine the composition of exhaust products, particularly hydrogen chloride and aluminum particles. The test sampling plan must be submitted for state approval 12 months prior to the first test and be implemented only for that test.
- Conduct a post-assessment of test effects on plants and wildlife within the near field zone (approximately 1-1/4 miles from the ASRM nozzle) for each test.
- Prepare and obtain state approval, 6 months after permit issuance, of a plan to monitor stress on plants and wildlife resulting from ASRM testing. The monitoring program should begin 2 years prior to the first test so that pre-test conditions will be known.
- Develop and implement a monitoring program to determine effects of ASRM testing on fish populations.
- Prepare and obtain approval, 12 months prior to the first test, of a detailed monitoring plan that includes four permanent air sampling and monitoring sites and at least three portable monitoring stations located according to an approved exhaust cloud path prediction plan.
- Operate two approved acid rain monitoring sites to analyze acidity levels and sodium, chloride, nitrate, sulfate, and aluminum concentrations.
- Sample surface soil at 28 distributed locations in predicted exhaust cloud path dispersion patterns. Soil analyses from these samples should include data on concentrations of total aluminum and soluble chlorides and acidity levels.

**Appendix I
State of Mississippi Conditions and
Restrictions on ASRM Testing at Stennis
Space Center**

- Obtain approval for a surface water quality monitoring plan, 3 months after permit issuance, to detect concentrations of total and dissolved aluminum, acidity, total dissolved solids, and total chlorides. One year of data must be submitted prior to the first static test.
- Ensure that ASRM testing causes no destruction of wetlands.
- Establish a network of groundwater monitoring wells surrounding the test stand area capable of sampling the ground water and conduct routine tests according to an approved sampling plan.
- Initiate research to control hydrogen chloride and particulate matter emissions from ASRM test firings. Such research should include engineering feasibility studies to assess existing technologies for removing pollutants from the rocket exhaust cloud before they are released into the atmosphere. A plan of study for this program should be submitted to the state within 6 months of the permit issuance. The first progress report from these studies is also required 12 months after the submission of the plan of study and on an annual basis.
- Obtain state approval of a professionally certified final design for the ASRM exhaust deflection ramp prior to beginning the construction of the ramp.¹ Every 3 years, NASA should reevaluate the effectiveness of the deflection ramp to limit air emissions.
- Provide state officials at least 4 weeks advance notice of each scheduled test so that a state representative may observe it.
- Develop and obtain state approval of a contingency and emergency response plan for dealing with an accidental release of high levels of pollutants that would result in ground level concentrations above EPA air quality standards. The plan must be submitted at least 12 months prior to the first test.
- Provide announcements to surrounding communities at least 48 hours prior to any test and provide updates of necessary changes to the test schedule. In addition, notify affected communities of any indicated dispersion deviation that results in projected measurements exceeding air quality standards or the acceptable ambient air quality level of hydrogen chloride. A plan to accomplish the required public notifications must be submitted to the state for approval 12 months prior to the first test.

¹This ramp will be placed 250 feet in back of the rocket nozzle to direct the exhaust upward and limit the upheaval of dirt particles.

NASA Sites on the Federal Facilities Docket

Table II.1 shows the 15 NASA facilities listed on the federal facilities docket. Preliminary assessments were conducted for these facilities as required by the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act. NASA contractors conducted site inspections at 10 of these facilities as a result of the preliminary assessments, and remedial action is underway at 11 of the facilities.

According to NASA and EPA officials, the Jet Propulsion Laboratory and Wallops Flight Facility may be included on EPA's listing of Superfund sites by the end of 1991. Also, three additional facilities—Ames Research Center, Langley Research Center, and Santa Susanna Field Laboratory—may be included as future Superfund sites. A brief description of each facility's potential hazardous waste problem, as determined by the preliminary assessments, is discussed below.

Jet Propulsion Laboratory,
Pasadena, CA

The city of Pasadena has alleged that ground water contamination of water supply wells was caused by past hazardous waste disposal activities.

Wallops Flight Facility,
Wallops Island, VA

Petroleum contamination of ground water has been identified at an old aviation fuel farm.

Ames Research Center,
Moffett Field, CA

NASA has been identified as a "potentially responsible party" for cleanup of an adjacent private industry Superfund site involving ground water contamination.

Langley Research Center,
Hampton, VA

Polychlorinated biphenyls and polychlorinated terphenyls were discovered in sediments in nearby Tabbs Creek; a center storm drain was identified as the likely source.

Santa Susanna Field
Laboratory, Ventura
County, CA

Groundwater contamination with trichloroethylene was identified.

**Appendix II
NASA Sites on the Federal Facilities Docket**

Table II.1: NASA Facilities Listed on the Federal Facilities Docket

Facility^a	Preliminary assessment	Site inspection	National priorities list	Remedial action
Ames Research Center, CA	Yes	Yes	^c	Yes
Dryden Flight Research Facility, CA	Yes	Yes	^c	^b
Goddard Space Flight Center, MD	Yes	Yes	No	No
Goldstone Tracking Facility, CA	Yes	No	No	No
Jet Propulsion Laboratory, CA	Yes	Yes	^b	Yes
Johnson Space Center, TX	Yes	Yes	No	Yes
Kennedy Space Center, FL	Yes	Yes	No	Yes
Langley Research Center, VA	Yes	Yes	^b	Yes
Lewis Research Center, OH	Yes	Yes	No	Yes
Michoud Assembly Facility, LA	Yes	^d	No	Yes
Plum Brook Station, OH	Yes	No	No	Yes
Santa Susanna Field Laboratory, CA	Yes	Yes	^b	Yes
Stennis Space Center, MS	Yes	^b	No	^b
Wallops Flight Facility, VA	Yes	Yes	^b	Yes
White Sands Test Facility, NM	Yes	^d	No	Yes

^aSpace Flight Center, AL, is not listed as a NASA facility; it is considered by EPA as part of the U.S. Army's Redstone Arsenal.

^bTo be determined.

^cTenant of Edwards Air Force Base Superfund site.

^dResource Conservation and Recovery Act facility investigation underway.

Major Contributors to This Report

**National Security and
International Affairs
Division,
Washington, D.C.**

**Frank Degnan, Assistant Director
Ilene Fliegel, Site Senior**

Dallas Regional Office

**James D. Berry, Jr., Evaluator-in-Charge
Rita F. Oliver, Site Senior
Dianna L. Taylor, Reports Analyst**

Ordering Information

The first copy of each GAO report is free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

**U.S. General Accounting Office
P.O. Box 6015
Gaithersburg, MD 20877**

Orders may also be placed by calling (202) 275-6241.

United States
General Accounting Office
Washington, D.C. 20548

Official Business
Penalty for Private Use \$300

First-Class Mail
Postage & Fees Paid
GAO
Permit No. G100
