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Report to Congressional Requesters

June 1997

ENVIRONMENTAL CLEANUP COSTS

NASA Is Making Progress in Identifying Contamination, but More Effort Is Needed

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June 27, 1997

The Honorable J. Dennis Hastert
Chairman
The Honorable Thomas Barrett
Ranking Minority Member
Subcommittee on National Security,
International Affairs, and Criminal Justice
Committee on Government Reform and Oversight
House of Representatives

This report responds to the request of the former Chairman and ranking minority member that we review the National Aeronautics and Space Administration's (NASA) environmental cleanup costs. The report expands on information provided in our September 1996 testimony on NASA infrastructure[1] and provides an assessment of NASA's (1) determination of the extent of contamination it may be responsible for cleaning up and progress in its cleanup program, (2) cost estimates for accomplishing cleanup, and (3) efforts to determine whether "potentially responsible parties" should share in cleanup costs.

Background

Like other entities, including federal agencies, NASA must comply with federal environmental laws, including the Resource Conservation and Recovery Act (RCRA) of 1976 and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. RCRA regulates the generation, transportation, storage, disposal, and cleanup of hazardous wastes. CERCLA creates a framework for carrying out cleanups, particularly for sites that have been abandoned and sites that pose the most severe environmental threat. The Environmental Protection Agency (EPA) administers RCRA and CERCLA, and it may authorize state agencies to implement all or part of RCRA responsibility. To carry out its responsibility, therefore, NASA needs to work with multiple regulators.

In our 1991 report,[2] we stated that NASA had not adequately implemented its policy to prevent, control, and abate environmental pollution. As a result of our 1991 report, NASA developed an environmental strategic plan and established an Environmental Management Division at the

[1]NASA Facilities: Challenges to Achieving Reductions and Efficiencies (GAO/T-NSIAD-96-238, Sept. 11, 1996).

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

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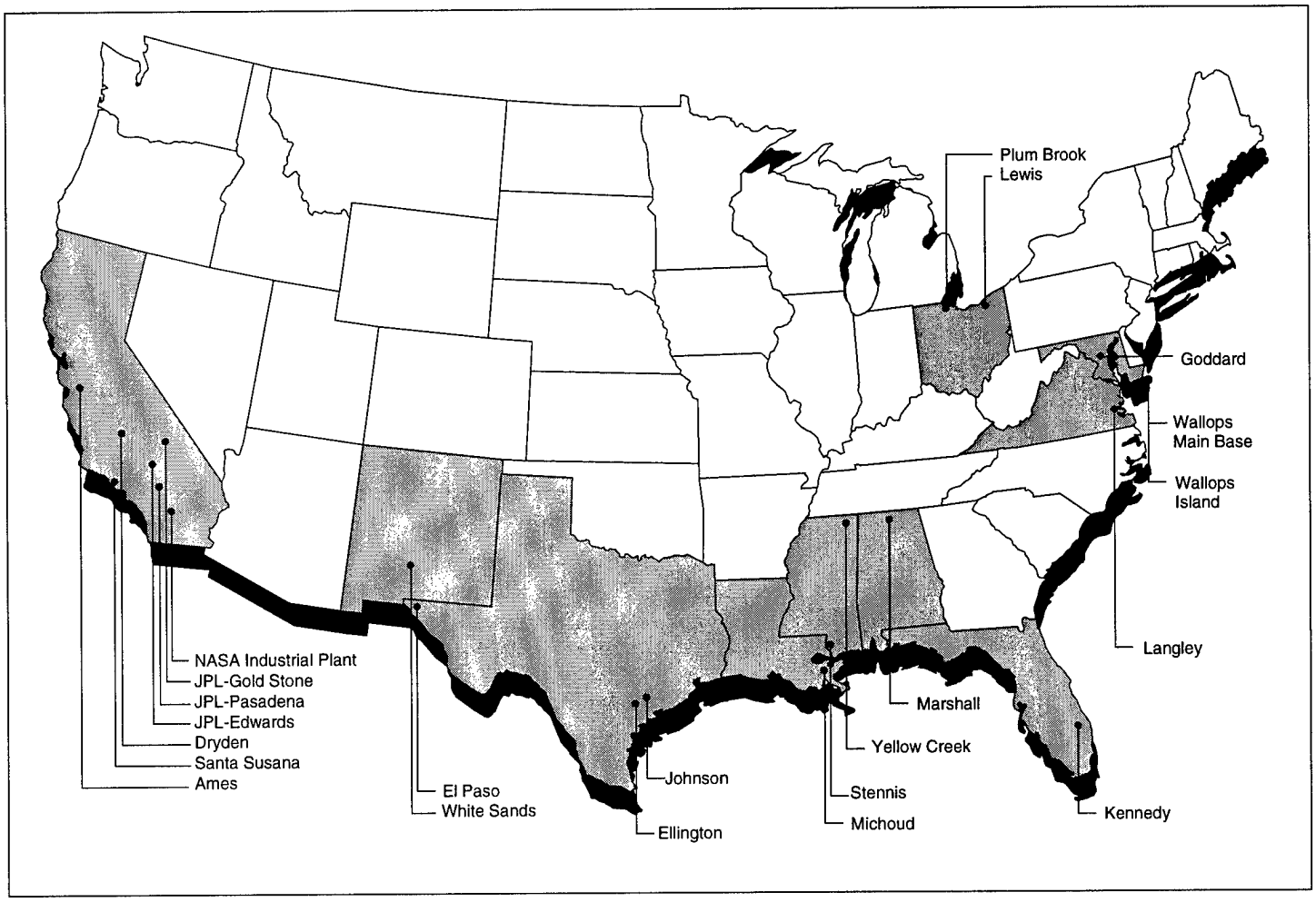
headquarters level. The environmental strategic plan includes a goal of remediating contaminated sites to protect human health and the environment as quickly as funds allow. To carry out this plan, NASA uses a decentralized management approach. Its field facility directors are responsible for day-to-day environmental matters, including remedial activities. The Environmental Management Division is the focal point for environmental matters. In our 1994 follow-up report,[3] we stated that NASA's environmental program still lacked implementation schedules and, if funding levels at that time continued, remedial activities would take longer than the 20 years NASA had predicted.

On the basis of its March 1996 site inventory, NASA identified 913 potentially contaminated sites at 22 of its field facilities in 10 states (see fig. 1).[4]

[3]Environmental Management (GAO/NSIAD-94-264R, Sept. 21, 1994).

[4]The NASA March 1996 inventory of 913 potentially contaminated sites was updated in August 1996. The update shows 919 sites. We did not believe that the increase from 913 to 919 significantly changed the March data; therefore, our analyses are based on the March 1996 inventory.

Figure 1: Location of NASA Field Facilities Having Potentially Contaminated Sites



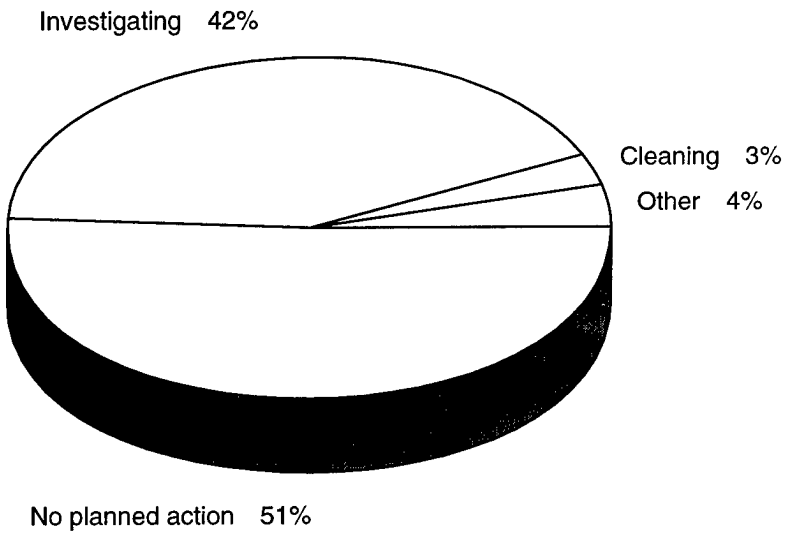
Source: NASA's hazardous site inventory database, dated March 1996.

Appendixes I, II, and III discuss specific data on NASA's cleanup costs at selected facilities (1) owned and operated by NASA, (2) owned by NASA and operated by a NASA contractor, and (3) owned and operated by a NASA contractor.

Results in Brief

Although NASA began identifying sites nearly 10 years ago, it did not complete a comprehensive hazardous site inventory database until 1993. NASA officials said that they now consider their inventory of 913 potentially contaminated sites to be about complete. However, the extent of environmental contamination is not yet fully known, and NASA facilities have a long way to go to effect cleanup of the contaminated sites. Figure 2 shows the percentage of potentially contaminated sites by cleanup status.

Figure 2: Percentage of Potentially Contaminated Sites by Cleanup Status



Source: NASA's hazardous site inventory database, dated March 1996.

NASA is also in the early stages of determining what it will cost to clean up those sites that require remediation. However, NASA needs better data before it can reliably estimate its cleanup cost. NASA headquarters had estimated its total cleanup costs would be $2 billion to clean up all its potentially contaminated sites over a 20-year period. It later lowered the estimate to $1.5 billion by eliminating sites where it believed no further action was needed. This estimate assumed that all sites of the same type would cost the same, regardless of variances in the extent of contamination. At our request, NASA field facilities developed estimates of

remediation costs totaling $636 million based on actual costs, local quotes, and input from other federal facilities. However, the field facilities' estimates excluded some of the 383 sites that had not been studied. Neither the headquarters nor the field estimates included long-term operation and maintenance costs[5] or considered NASA's potential costs for remediation at its contractor facilities. Furthermore, neither estimate considered the potential effect of infrastructure changes that could increase remediation cost. For example, depending on planned future use after facility closure, regulators could require NASA to clean up to a higher, more costly residential-use standard rather than the lower, industrial-use standard currently being applied to NASA facilities. Although NASA's overall budget is projected to decline over the next few years, NASA headquarters is projecting that environmental funding will remain about level in fiscal year 1998, then increase somewhat over the following 4 years. However, some field facilities indicated they were planning to request major environmental funding increases. As a result, NASA will need to consider how it will prioritize the various funding requests.

CERCLA allows federal agencies and other entities that carry out cleanup activities to seek cost sharing or cost recovery from the potentially responsible parties whom the law would hold liable, such as past owners, operators, and contractors. CERCLA cost recovery can also be available to a party conducting a cleanup under RCRA corrective action requirements. Despite the availability of a cost recovery mechanism, NASA headquarters has not had a policy for determining whether to seek contributions from other parties. NASA is paying the remediation costs for virtually all of its field facilities. Except for a few cases involving contractor negligence, NASA facilities have not identified if there are opportunities for recovering costs from potentially responsible parties. After we discussed the preliminary results of our review with NASA officials, they reported that they are now developing a policy statement addressing the issue of identifying and pursuing potentially responsible parties where appropriate.

[5]Subsequent to our field work, NASA headquarters used a new cost model that considers site differences, and at least 5 years of long-term operation and maintenance costs. Using preliminary data in the new model, NASA estimated that the future cleanup cost would be $1.4 billion for an estimated 679 sites potentially requiring remediation.

Further Investigations Are Needed to Fully Determine the Extent of Contamination and Cleanup Is Just Beginning

NASA officials said that their inventory of potentially contaminated sites is now considered complete; however, further investigations are needed to determine the extent of required cleanup for most sites. The actual cleanup of some sites is just beginning.

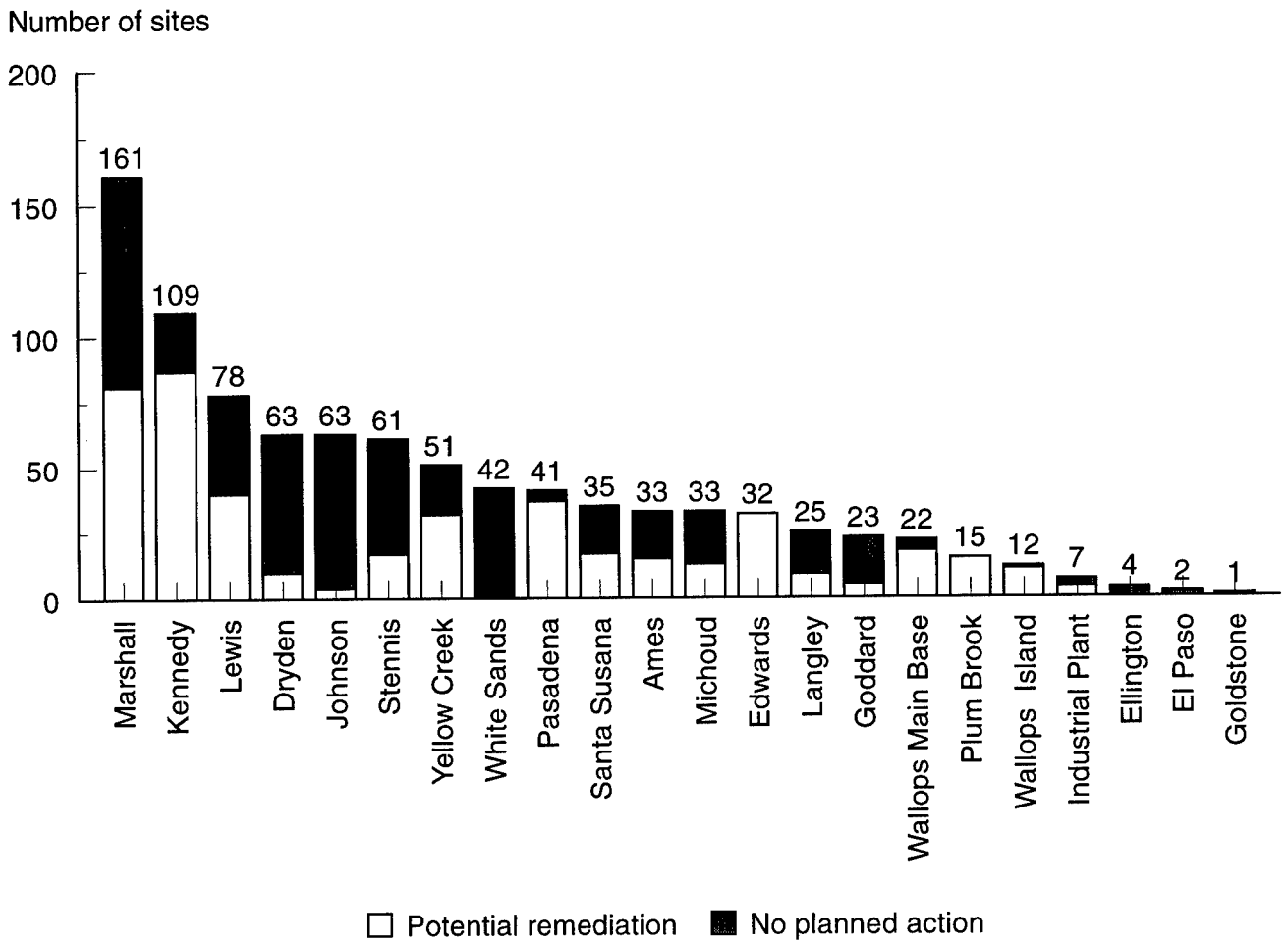
Extent of Contamination Is Not Fully Known

In 1988, NASA headquarters began efforts to identify contaminated sites at most of its facilities.[6] However, a comprehensive hazardous site inventory database was not completed until 1993. NASA officials said that they have identified practically all of their potentially contaminated sites. One exception is the NASA Industrial Plant at Downey, California. The Downey facility was not part of NASA's overall inventory effort because the facility was not disposing of hazardous waste and was not a large generator of hazardous waste. A recently completed study shows that four of the six parcels comprising the Downey facility require no remediation. A contract to study the other two parcels is underway. These two parcels are more likely to contain contaminated sites, but pending the completion of the study, the number of such sites will not be known.

Figure 3 shows NASA's reported number of sites in the cleanup phase or potentially requiring remediation (447) as well as the number of sites that have no planned action (466) for each of the NASA field facilities.

[6]NASA field facilities have been identifying potentially contaminated sites since the 1980s. For example, the George C. Marshall Space Flight Center and the Michoud Assembly Facility identified some sites in the early 1980s, and the John F. Kennedy Space Center identified 21 sites in the mid-1980s.

Figure 3: Breakdown of the Number of Sites in the Cleanup Phase or Potentially Requiring Remediation and of Sites Having No Planned Action



Source: NASA's hazardous site inventory database, dated March 1996.

NASA's potentially contaminated sites were often identified through various activities. For example, at the John F. Kennedy Space Center in Florida, one of the contamination problems was discovered when workers became ill while digging holes for telephone poles during the late 1980s. At the Santa Susana Field Laboratory in California, groundwater contamination

problems were discovered during an investigation of site water supply wells in 1984. At the Langley Research Center in Virginia, contamination of a creek bed was discovered during a 1988 study of marine life in the area.

Some NASA sites are on the National Priorities List of highly polluted sites established by EPA under CERCLA. NASA's Dryden Flight Research Center in California, the Langley Research Center in Virginia, and the George C. Marshall Space Flight Center in Alabama have been placed on the list and are jointly listed with collocated Department of Defense (DOD) sites. The Jet Propulsion Laboratory in Pasadena, California, is also on the list. The national priorities designation requires that these sites follow the CERCLA process during remediation. Other NASA facilities had the choice of following either CERCLA or RCRA processes to clean up contaminated sites. NASA states that because the facilities that are being cleaned up have RCRA permits, RCRA is the cleanup authority it will use.

Cleanup Is in Early Stages and Estimates for Completion Are Unreliable

The status of NASA's potentially contaminated sites is summarized in table 1.

Table 1: Status of NASA's Potentially Contaminated Sites

Status	Number	Percent
No planned action		
Closed without need for remediation	57	6
No further action planned[a]	200	22
Need inspection upon closure	209	23
Subtotal	**466**	**51**
Potential remediation		
Remediated or being remediated	31	3
Classified as "other"	33	4
Needing investigation/being investigated	383	42
Subtotal	**447**	**49**
Total	**913**	**100**

[a]NASA's August 1996 update shows that 35 of the 200 sites requiring no further action were placed in categories requiring further action, therefore reducing the 200 to 165.

The sites with no planned action (466) were sites where there was thought to be some contamination; however, preliminary reviews of the sites showed no contamination or a level of contamination within EPA's

acceptable limits. For example, one site identified from an aerial observation at the Langley Research Center proved to be simply an area where vehicles had been washed and not a site containing contamination.

Of the sites NASA classifies as potentially requiring remediation (447), a large number of sites (383) still require investigating or are being investigated to evaluate the extent of contamination and the need for cleanup. NASA headquarters officials said that these investigations are not scheduled to be completed until the end of 1997, but some field facilities expect the investigations to be completed later. For example, the Marshall Space Flight Center is slated to complete its investigations in mid-1998, the Michoud Assembly Facility in Louisiana does not plan to complete its investigation until 1999, and the Kennedy Space Center does not expect to complete its investigation until the end of 1999. Until these investigations are completed, the type and extent of contamination and the need for cleanup are uncertain.

Although NASA headquarters estimates a 20-year period for cleaning up contaminated sites, it is not well-supported. For example, neither it nor its field facilities have a detailed time schedule for accomplishing the cleanup. Only 31 contaminated sites, or 3 percent, have been or are being remediated.

Field facility officials cited other reasons, in addition to the relatively slow start, for not being further along in the remediation process. For example, there have been difficulties in dealing with multiple federal and state agencies and getting them to agree on the level of cleanup necessary. The Langley Research Center, in its attempts to get concurrence on the level and method of cleanup required for one of its sites, has been giving data to a number of different regulators and has been responding to questions relative to this cleanup for over 8 years. A chronology of correspondence shows that the regulators and Langley have exchanged over 100 documents during this period.

Better Data Are Needed Before Reliable Cleanup Cost Estimates Can Be Made

NASA field facilities reported spending $117 million through fiscal year 1995 for remedial activities, not including management costs.[7] Most of these funds were used for precleanup activities. Making accurate estimates of NASA's additional cleanup cost is not possible because the extent of contamination for most sites that may require remediation has not been determined. At the time of our field work, NASA headquarters estimated that remediation would cost $1.5 billion.[8] NASA field facilities provided estimates totaling $636 million. However, the two estimates are not comparable. The headquarters' estimate considers all sites of the same type to cost the same, regardless of variances in extent of contamination, and the field facilities' estimates do not include all potential sites such as those still being studied. Neither estimate includes all long-term operations and maintenance costs nor any costs for NASA's potential remediation liability at its contractor facilities. The estimates also do not consider potential effects of infrastructure changes. Any of these costs could significantly increase the potential remediation cost. Accordingly, it is likely that NASA will have to make priority decisions on cleanup expenditures.

Past Expenditures Were Predominantly for Precleanup Activities Rather Than Cleanup

Most of the $117 million spent to date on remedial activities ($83 million) has been spent on such preliminary activities as investigations or studies. For example, information provided by the Pasadena facility showed that all of its expenditures ($11 million) had been spent on precleanup activities, and information provided by the White Sands Test Facility in New Mexico showed that virtually all of its expenditures ($28 million) had been spent on precleanup activities. Only three field facilities—Ames Research Center in California, Lewis Research Center in Ohio, and Michoud Assembly Facility in Louisiana—spent more on cleaning up than on conducting studies and investigations.

[7]Management costs include NASA's cost for personnel who manage the remediation program. DOD designates such costs as remediation costs, while NASA cannot accurately break out or identify these costs as remediation.

[8]Subsequent to our field work, NASA headquarters, using a new cost model that considers site differences, estimated that the future cleanup cost would be $1.4 billion for an estimated 679 sites potentially requiring remediation.

Accurate Estimates of Future Cost Are Not Possible Without Better Data

NASA's site inventory, which is maintained by headquarters and updated by the field facilities, should list cleanup cost estimates developed by each facility for each of its sites. However, NASA's inventory contained site-specific cost estimates for only 19 percent of the sites[9] that may require remediation because the process of developing such data is in the early stages at most facilities. Moreover, many of the cost estimates are only for the early stages of the remediation process and may not include the total cleanup cost.

Using parts of a DOD cost model, which involved an average cleanup cost of 17 separate classes of environmental problems, NASA headquarters developed the remediation estimates used at the time of our field work. The average cost of the specific class was multiplied by the number of sites within the class. For example, one contamination class was "contaminated sediment," which had an average remediation cost of $2.7 million per site. Therefore, the model required multiplying the number of NASA's contaminated sediment sites by the $2.7 million. NASA said that the model may have overstated its remediation estimate because most DOD sites were larger and probably more polluted than NASA sites. According to NASA officials, the DOD model was the best available approach in 1993.

NASA's estimate of $1.5 billion was a reduction of $500 million from its original estimate of $2 billion. The reduction resulted from a NASA headquarters' decision to eliminate all sites that are classified as requiring no further action from the original cost estimate. This reduction appeared appropriate based on available data.

NASA recognizes that some classes of sites, such as landfills and water treatment facilities, may require annual operation and maintenance expenses; however, such costs were not included in NASA headquarters' estimate of $1.5 billion.[10] An example is contaminated groundwater that may be remediated through a process known as "pump and treat," where contaminated water is extracted from the ground, treated, and then reinjected. This process can be continued for decades, thereby requiring continued operations and maintenance expenditures. For these sites, significant post-cleanup costs could last indefinitely. DOD has found that

[9]Subsequent to our field work, a NASA headquarters' contractor, using a new cost model, updated the site cost estimates to include all sites that NASA expects to clean up. NASA believes that this new model, when fully implemented, will provide significantly improved cost estimates for its cleanup costs.

[10]Included in NASA's new cost model is an estimate for at least 5 years of operation and maintenance for those sites that NASA currently projects will require such activities.

annual operation and maintenance costs can be as high as 25 to 30 percent of cleanup costs.

To determine if a more reliable cost estimate could be developed, we visited a number of NASA field facilities and sent requests for data to other facilities. From data that the field facilities provided, we compiled a total cost estimate of $636 million for past ($117 million) and future ($519 million) remediation costs.

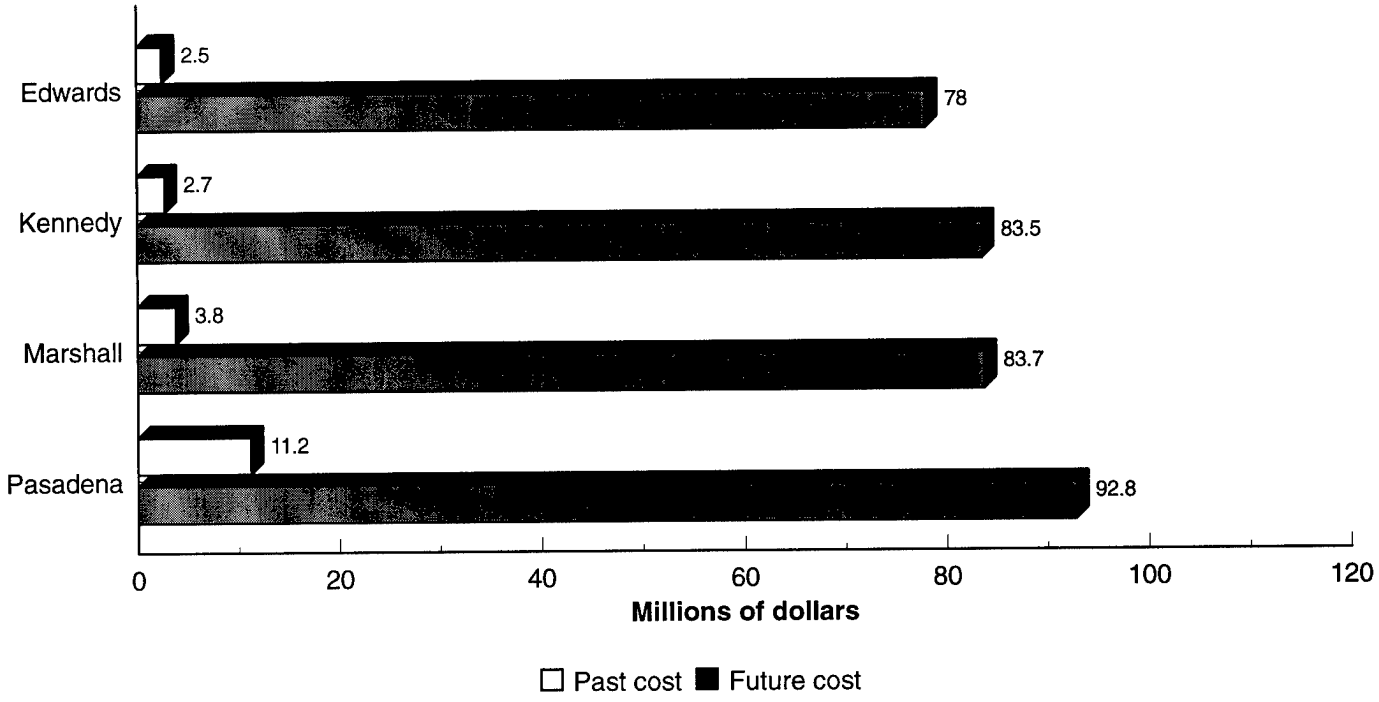
The field facilities' estimates were significantly lower than the headquarters' estimate. For example, for one of the facilities with the most potentially contaminated sites (Kennedy Space Center), the headquarters' estimate of $379.6 million significantly exceeds the facility's estimate of $86.2 million. According to Kennedy officials, their estimates are based on actual costs, local quotes, input from other federal facilities, and information from the Remedial Action Engineering and Requirements System, which is an environmental cost estimating system based on site-specific data. Although the Kennedy estimate may be more accurate than the headquarters' estimate for the sites investigated to date, Kennedy has not yet completed cleaning up any of its sites or investigating many of its sites and the facility's estimate only includes sites that are projected for cleanup through 2002, although remediation is not expected to be completed until 2008.

Two facilities with fewer sites than Kennedy that are further along in studying contaminated sites also show a much lower estimate than the headquarters' estimate. The Langley Research Center shows a projected total cleanup cost of $6.2 million compared to the headquarters' estimate of $29.3 million, while the Ames Research Center shows a total projected cleanup cost of $19.6 million compared to the headquarters' estimate of $44.2 million.

Although NASA field facilities currently estimate future remediation will cost $519 million, some facilities are negotiating with federal and/or state regulators on the extent of cleanup needed. The results of such negotiations will affect the amount needed for cleanup. For example, the Langley Research Center has been negotiating with EPA for years on the level of cleanup for one of its sites. Depending on the level agreed to, Langley's cleanup cost for this one site could range from $2 million to $100 million.

Figure 4 shows the amount of money that selected field facilities spent through fiscal year 1995 compared to the amount they expect to spend in the future.

Figure 4: Amount of Money Spent Through Fiscal Year 1995 Compared to Projected Expenditures



Source: NASA's hazardous site inventory database, dated March 1996.

Potential Costs for Cleanup at Contractors' Facilities Could Be Significant

Other costs not captured in NASA's remediation cost estimates need to be considered. For example, NASA has not determined how much it is or could be paying through overhead charges to clean up contaminated facilities owned and operated by its contractors or what its potential future cleanup costs are at contractor-owned sites. To develop such estimates, we sent a request to 20 of NASA's largest contractors and asked for (1) NASA payments to them during the past 2 years for their cleanup costs and (2) their estimates of future cleanup costs at their facilities.

Of these 20 contractors, 16 responded. NASA has paid $22 million to clean up environmental contamination at these contractor plants during the past 2 years through reimbursing contractors' overhead charges. In terms of future cleanup costs, these contractors expected such costs to be over $1 billion. This estimate, however, did not include the costs for NASA's largest contractor because it did not provide future costs. That contractor has NASA contracts worth over $35 billion.

Cost Impact of Potential Infrastructure Changes Is Uncertain

An additional uncertainty regarding NASA's future remediation cost is the potential impact if any field facilities are closed and cleanup is to a higher land-use standard. In our September 1996 testimony on NASA infrastructure,[11] we stated that the impact of environmental cleanup requirements on NASA's property disposal decisions is not yet well known.

CERCLA requires that the government clean up property before selling or transferring it to others. Typically, this requires that the future use of the property be established and cleanup be done in accordance with the planned use. Most NASA facilities are currently used for industrial activity. As might be expected, the cleanup standard for industrial use property is lower than what would be required for residential use. NASA officials believe that if the agency chooses to dispose of a property, regulators could require NASA to clean up to a residential use as opposed to an industrial-use standard. Although field facilities had not prepared actual cost estimates, about half of the facilities contacted believed that if their facilities were closed, cleanup costs would increase significantly. For example, the White Sands Test Facility estimated costs could nearly double; the Marshall Space Flight Center believed they could triple; and the Lewis Research Center believed they could quintuple. However, ultimately the effect of closures on cleanup costs would have to be decided on a case-by-case basis.

Future Funding Will Require Priority Decisions on Cleanup

According to the NASA fiscal year 1998 budget estimate to the Congress, NASA's overall budget is projected to decline by nearly 4 percent over the next 5 years. This decline is even more dramatic when the projected available funds are adjusted for inflation. In terms of 1997 dollars, the decline is projected to be over 20 percent over the 5-year period. NASA's environmental budget line, which is $33 million for fiscal year 1997, is currently projected to remain at about the same level in fiscal year 1998,

[11] NASA Facilities: Challenges to Achieving Reductions and Efficiencies (GAO/T-NSIAD-96-238, Sept. 11, 1996).

then increase to an average of about $50 million over the following 4 years. Considering inflation, this amount will be worth less in later years.

NASA does not separately identify remediation in its environmental budget. In fiscal years 1993 and 1994, remediation was about 50 percent of the environmental budget. By 1996, remediation had grown to about 65 percent, and it is expected to remain at that level in the future. Since NASA's two facilities with the greatest number of contaminated sites—Kennedy Space Center and Marshall Space Flight Center—are intensifying their remediation efforts, it is likely that NASA will have to prioritize environmental remediation expenditures as remediation efforts intensify. This is further demonstrated by NASA's change in the projected environmental budget for the year 2000, or a decline from $70 million in its fiscal year 1996 estimate to $52 million in its fiscal year 1998 estimate.

Policy Is Needed to Determine Whether Other Parties Should Be Sharing Cleanup Costs

Although CERCLA allows NASA to recover cleanup costs from past and present owners and operators and from other potentially responsible parties, NASA headquarters has not yet developed an overall policy relating to determining the potential for recovery of costs. To date, NASA field facilities have only made limited efforts to determine whether there may be opportunities to recover cleanup costs. Except for other federal agencies and a few contractor negligence situations, NASA generally has not identified whether potentially responsible parties should be sharing costs. However, field facility officials said that opportunities for doing so may exist.

Cost Recovery Policy Has Not Been Developed

Two federal environmental laws, RCRA and CERCLA, require remedial action to clean up property contaminated with hazardous substances that pose a threat to health or the environment.[12] Both RCRA and CERCLA impose a responsibility for cleanup on the owner and/or operator of a facility. Under CERCLA, the party carrying out a cleanup may seek cost reimbursement from other persons whom the law would hold liable. Persons include past owners, operators, contractors, and a broad range of other potentially responsible parties. CERCLA cost recovery can also be available to a party conducting a cleanup under RCRA.[13]

[12]Which law governs depends on the circumstances, including whether the site is on the National Priorities List.

[13]42 U.S.C. 9607(a)(4)(A) allows a federal agency to recover cleanup costs for removal or remedial actions "not inconsistent with the National Contingency Plan." EPA regulations on cost recovery are found in 40 C.F.R. § 300.700(c).

Despite the potential for cost recovery, NASA has not issued a policy or guidance to field facilities to govern the recovery of cleanup costs where appropriate. However, the agency is in the process of drafting a policy statement requiring the identification of potentially responsible parties from whom contributions might be sought.

Cost Recovery Efforts to Date

We noted two situations where NASA identified contractor negligence resulted in contamination requiring cleanup. In these cases, NASA recovered some of the cost from the contractors involved. One situation occurred at the Ames Research Center in 1992. A contractor left a fueling operation unattended and spilled about 2,500 gallons of jet fuel. NASA pursued the contractor for negligence and negotiated a recovery of $204,000 of the cleanup cost from the contractor. In the second situation, a support services contractor at the Lewis Research Center dumped lead paint on the ground, resulting in a cleanup bill for Lewis of $100,000. The entire sum was withheld from the contractor's payment on its support services contract.

Another situation where NASA's cleanup cost is likely to be shared involves groundwater treatment at NASA's Ames Research Center. NASA, as a named party in a record of decision that EPA issued in 1989, is in the process of finalizing an agreement with other potentially responsible parties, including private companies operating on adjacent property, that would require NASA to pay the companies $1.4 million of the estimated $5.5 million cleanup costs. Thereafter, the private firms, and not NASA, would pay for and conduct the groundwater cleanup.

NASA Is Paying Costs of Ongoing Cleanups

During our review, we found a number of other situations in which NASA has paid or is paying to clean up contamination that involved other parties. In one example, a 1966 spill of 16,000 gallons of trichloroethylene at the Michoud Assembly Facility seeped into groundwater and created significant contamination. NASA has historical records to identify the contractor that operated the facility at the time of the spill as well as other contractors on the property at the time. However, a 1993 search of contract and insurance records from the 1960s did not produce any contractual documentation. According to Michoud officials, because of the lack of documentation and because the contamination occurred during the 1960s, NASA will probably not try to recover costs from the past contractors.

Another example involves the Kennedy Space Center. Until our review, Kennedy had not searched for contractors or other responsible parties to contribute to costs. According to Kennedy officials, the conventional view has been that, as the owner and operator of its facility, NASA oversees contractor operations and is, therefore, responsible for any contamination.

As a result of our inquiries, Kennedy's legal office and Environmental Management Office officials said that they plan to be more aggressive in determining whether there are cost recovery opportunities. For example, Kennedy officials believe that they may be able to obtain reimbursement for cleanup costs attributable to the actions of a former landowner that operated a private business on the site that contaminated groundwater. Kennedy has constructed a water treatment facility ($265,000) that pumps and treats contaminated groundwater, and it is paying for the operation and maintenance of the facility ($168,000 a year since 1991). Kennedy officials said they plan to continue the present cleanup strategy until contamination is reduced to acceptable levels and, following treatment, they will attempt to determine whether to pursue the former landowner. In another case, Kennedy plans to clean up fuel oil contamination that occurred when a storage tank leaked gasoline or diesel fuel at its visitor's center. Cleanup involves removing and aerating soil at the site. At the time of the contamination, a private company leased the visitor's center. Kennedy officials believe that the lessee had control of the situation and should be held responsible. According to Kennedy officials, the lessee paid for the remedial investigation at the site before Kennedy assumed control of the cleanup. Kennedy took over the cleanup because another lessee now occupies the center. Kennedy's projected remediation cost for the visitor's center is $3.5 million. After the cleanup is completed, Kennedy will decide whether the former lessee should be asked to reimburse the government.

The Santa Susana Field Laboratory is another situation where NASA officials need to decide whether it should pursue cost sharing. NASA owns some of the land at Santa Susana, but most of the facility is a contractor-owned and -operated plant. The major problem at the Santa Susana facility is groundwater contaminated with trichloroethylene. The contamination, according to a NASA-funded study, occurred primarily in the 1950s as a result of contractor rocket testing for the Air Force. That testing was carried out by the same contractor that still owns the facility and most of the land. NASA has paid for groundwater treatment on its property, and it has tried over the past few years to get the Air Force to pay more of the cleanup costs. To date, the Air Force has refused, pointing to the

contractor as the party principally responsible for the contamination. While the debate continues over who should contribute and how much, NASA is paying the largest portion of the groundwater treatment costs.

Recommendations

We recommend that the NASA Administrator

- establish facility-based, implementation schedules for completing cleanup of contaminated sites;
- estimate probable future costs by (1) identifying all site-specific costs, including operation and maintenance costs, for sites believed to require remediation, (2) requesting contractors' remediation cost estimates for cleaning up contamination at contractor facilities that could represent future costs for NASA and taking any necessary contract action to require such estimates in the future, (3) identifying infrastructure changes, such as planned property use and applicable cleanup standards that are consistent with requirements for the Annual Accountability Report, and documenting the impact of facility closure decisions on environmental cleanup costs;
- prioritize the application of environmental funds in its cleanup efforts; and
- issue a policy statement concerning potentially responsible parties and cost recovery.

Agency Comments and Our Evaluation

NASA generally concurred with our recommendations, except for questions in two areas—(1) requiring contractors to provide remediation cost estimates for cleaning up contamination at contractor facilities that could represent future costs for NASA and (2) identifying infrastructure changes, such as planned property use and applicable cleanup standards, and documenting the impact of facility closure decisions on environmental cleanup costs.

NASA said that estimates of contractor cleanup costs that would be allowable and allocable under future contracts would be speculative. We agree that such estimates would not be firm, but we believe that even a preliminary estimate of the total amount NASA could be paying to contractors in the form of indirect costs would help to provide a more complete picture of its environmental cleanup costs. As we note in the report, NASA's remediation cost estimates do not show the amount that it is paying through overhead charges to clean up contaminated contractor facilities or its potential future costs at such facilities. NASA also stated that it is not clear if it can require contractors to estimate the costs of future cleanup at contractor facilities. To the extent that existing contracts do

not support such a requirement, we believe that, when an opportunity arises, NASA should include in its contracts the authority to require estimates of future cleanup costs. In the meantime, NASA at least needs to ask contractors for such estimates. All but one of the contractors responding to our survey provided that information to us, and contractors also have provided environmental cost estimates to DOD. We have modified our recommendation accordingly.

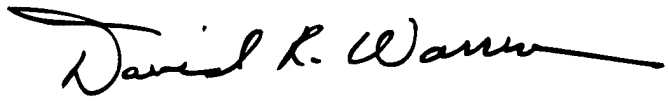
NASA agreed that environmental costs need to be identified as soon as possible but believed our recommendation to identify infrastructure changes and costs go well beyond requirements to identify costs for its Annual Accountability Report, using best available data. Our recommendation did not intend to recommend identifying cost impacts where changes are not yet planned, so we modified our recommendation to clarify our intent.

NASA comments are reprinted in full in appendix V. NASA also provided suggested editorial and technical changes and supplied updated information. We have incorporated this additional information in the report where appropriate.

We performed our review from October 1996 through May 1997 in accordance with generally accepted government auditing standards. The scope and methodology for our review are discussed in appendix IV.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time, we will make copies available to interested congressional committees; the Administrators, National Aeronautics and Space Administration and the Environmental Protection Agency; and the Director, Office of Management and Budget. We will also make copies available to others on request.

If you have any questions on this report, please call me on (202) 512-8412. Major contributors to this report are listed in appendix VI.



David R. Warren, Director
Defense Management Issues

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Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	Department of Defense
EPA	Environmental Protection Agency
NASA	National Aeronautics and Space Administration
RCRA	Resource Conservation and Recovery Act

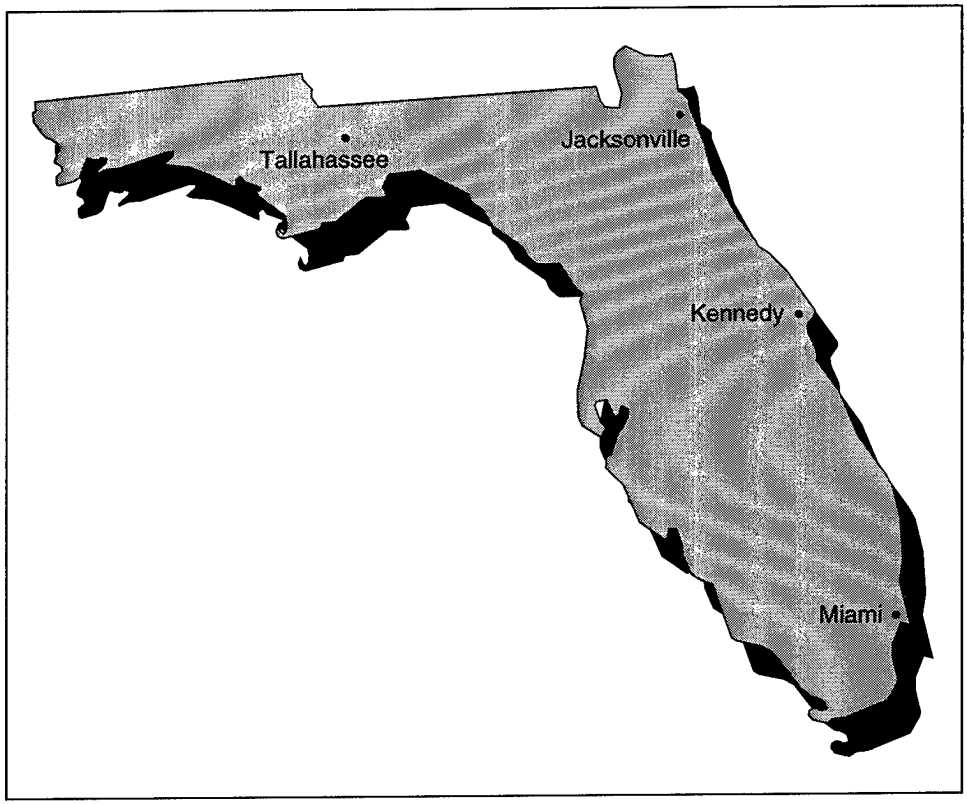
John F. Kennedy Space Center

Background

Site Description and Mission

The John F. Kennedy Space Center is a government-owned, government-operated facility located on the east coast of Florida on Merritt Island near the Cape Canaveral Air Force Station (see fig. I.1). Kennedy contains the Merritt Island wildlife preserve and the Cape Canaveral National Seashore.

Figure I.1: Location of the Kennedy Space Center



Source: NASA Real Property Locations by Accountable Reporting Installations.

Kennedy is the National Aeronautics and Space Administration's (NASA) main facility for launching space vehicles, and it also serves as a landing site. Kennedy's role in the space program includes the assembly, checkout, and launch of payloads and space vehicles. Currently, it is focused on the

space shuttle and on preparing for the integration and launch of space station elements.

Regulatory Process

In the 1980s, Kennedy began its remediation process by determining if any contamination posed hazards to human health or the environment, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Kennedy officials said, however, at that time there was little or no focus on cleaning up sites. In 1986, Kennedy elected to proceed with cleanup under the Resource Conservation and Recovery Act (RCRA) corrective action process. RCRA regulates hazardous waste from its origin through its ultimate treatment, storage, or disposal.

The Environmental Protection Agency (EPA) and Florida's Department of Environmental Protection are responsible for monitoring Kennedy's compliance with environmental law. Kennedy works with the concerned regulatory agency to reach agreements on the types of remediation activities and on the dates they will be carried out.

Extent of Contamination

Within NASA, Kennedy has the second largest inventory of potentially contaminated sites. According to Kennedy officials, their site inventory should be about complete, and they expect to complete site remediation by 2008 and operation of water treatment facilities by 2015.

Contaminated Sites

In performing its mission, Kennedy has generated waste that includes petroleum, metals, solvents, adhesives, and sandblast residues. This waste is considered to be ignitable, corrosive, and/or toxic. It has contaminated the soil and groundwater and may be a danger to human health. Contamination usually results from improper disposal, leaks, or spills.

Although NASA headquarters' March 1996 inventory of potentially contaminated sites shows that Kennedy has 109 sites, Kennedy records show that it has 127 sites. According to a Kennedy official, the disparity occurred because Kennedy included all potential release sites in its inventory. It will not report some of these sites to headquarters as potentially contaminated sites until it conducts further investigations.

Seven of the sites are on the Cape Canaveral Air Force Station where Kennedy has operated in the past. Kennedy's sites were identified (1) by routine sampling, (2) at areas where spills were not completely cleaned

up, or (3) in response to a concern voiced by an employee or a regulatory agency. Kennedy officials believe that all potential sites have been identified.

Cleanup Status and Schedule

The remediation status of Kennedy's 127 potentially contaminated sites is shown in table I.1.

Table I.1: Remediation Status of Kennedy's Sites

Status	Number
Cleanup in progress	1
Risk assessment completed	6
Being investigated	20
No further action contemplated	31
Need to be investigated	69
Total	**127**

The only contaminated site that Kennedy is currently cleaning up is the Wilson Corners site. The Wilson Corners site was where a previous landowner operated a component cleaning facility from the late 1950s through 1963. Kennedy purchased the site in 1963, and according to Kennedy officials, the prior landowner continued to operate the cleaning facility until 1965 when all operations ceased. According to Kennedy officials, most of the contamination occurred before Kennedy purchased the site. The contaminants are trichloroethylene and its degradation products. Kennedy started remediation in 1989 when it constructed a water treatment system. Remediation now entails pumping groundwater from 23 recovery wells and treating it. Kennedy monitors the influent, treated effluent, and the recovery wells. The cleanup completion for this pump and treat procedure usually takes years and sometimes is not completely successful. The site is now vacated and surrounded by a fence.

According to Kennedy officials, by 1991, hazardous waste releases causing contamination stopped. They said that current schedules project remediation, on an average, of nine projects a year, and they estimate remedial actions may be completed at all sites by 2008. They said, however, water treatment facilities may need to be operated for about 7 additional years. Thus, Kennedy's cleanup effort may be completed by 2015.

Cost to Clean Up Contamination

NASA headquarters estimates that it will cost $379.6 million to clean up Kennedy's contaminated sites. This estimate was derived from selected portions of a Department of Defense (DOD) cost model that multiplies the average cost for a type of cleanup by the number of sites estimated to require cleanup of that type. Kennedy's estimate of $86.2 million is much less than NASA headquarters' estimate and is based on site-specific data. Kennedy's estimate, however, only includes sites that are projected for cleanup through 2002, while the headquarters estimate includes all sites potentially requiring cleanup.

Historical Costs

Kennedy spent a total of $2.7 million through fiscal year 1995 from NASA's construction of facilities funds and from Kennedy's program mission support funds on remediation. According to Kennedy officials, NASA's construction of facilities funds for environmental remediation can be held and spent in any year, and local annual program mission support funds can be used during the budget year, as needed, for remediation activities such as site investigations and long-term operations and maintenance.

For fiscal years 1990 through 1995, NASA headquarters authorized about $5.5 million from its environmental construction of facilities funds for remediation at Kennedy. From these funds, Kennedy has spent $1.6 million through fiscal year 1995 on remedial investigations. It has not spent any construction of facilities funds on remedial design or remedial action projects. For the one site being cleaned up (Wilson Corners), Kennedy is using its local program mission support funds. Thus far, the cost of this remedial action has been about $1.1 million. It consists of the construction of a water treatment facility ($265,000) and the facility's operations and maintenance ($168,000 annually since 1991). Kennedy officials said plans to use authorized construction of facilities funds have been delayed because of slow regulatory reviews.

In regard to off-site contamination, Kennedy has not been involved in the cleanup of any contractor-owned or third-party contaminated sites. Additionally, officials said that they are not aware of any overhead charges being added to their contracts because of environmental cleanups at contractor facilities.

Future Costs

Kennedy estimates that it will spend $83.5 million for fiscal years 1996 through 2002 on 42 contaminated sites (see table I.2). According to Kennedy officials, the remaining sites (85) have not been investigated

enough to estimate remediation costs or, moreover, to determine if they require cleanup.

Table I.2: Kennedy's Projected Remediation Costs for Fiscal Years 1996 Through 2002

Dollars in millions

	Fiscal year							
Remediation phase	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**Total**
Investigation	$3.8	$4.6	$2.5	$1.0	$0.2	0	0	$12.1
Design	0.1	0.8	1.1	0.7	1.0	$0.2	0	3.9
Action	1.1	5.4	14.1	15.5	12.8	15.9	$2.7	67.5
Total	**$5.0**	**$10.8**	**$17.7**	**$17.2**	**$14.0**	**$16.1**	**$2.7**	**$83.5**

Kennedy has not projected remediation costs beyond 2002, although the cleanup is not expected to be completed until 2015. Kennedy officials said they will not have complete and accurate cost estimates until 1999. To do this, they will have to obtain data on the amount and type of contamination at each site and determine the risks associated with the location, amount, and contaminant types.

Cost Sharing Efforts

Neither NASA headquarters nor Kennedy has developed any definitive guidance in terms of pursuing potentially responsible parties to share cleanup costs. To date, Kennedy has not pursued any potentially responsible parties.

Cost Sharing Policy

CERCLA allows a party conducting a cleanup to recover cost from potentially responsible parties. These parties may include present and past owners, operators, and contractors, among others.[1] NASA headquarters, however, has not yet provided any written guidance to Kennedy on sharing remediation costs. Accordingly, Kennedy has not issued a written policy on recovering of remediation costs from potentially responsible parties.

Kennedy's Chief of the Environmental Management Office said that potentially responsible parties should be pursued in appropriate cases and believes that the potentially responsible party issue needs to be resolved at the NASA headquarters level. When a potentially responsible party can be found, Kennedy's stated policy is to conduct the cleanup and then decide whether to seek reimbursement.

[1]A federal agency conducting a RCRA corrective action can qualify for CERCLA cost recovery if its cleanup actions are "not inconsistent with the National Contingency Plan."

Cost Sharing Practices

NASA has always considered environmental contamination on Kennedy's property to be the result of its activities because NASA operates its facility and oversees its contractors. According to Kennedy officials, however, contractors should assume some responsibility for their actions and should participate in cost sharing agreements for remediation because contractors perform the vast majority of industrial operations at Kennedy.

We discussed cases in which Kennedy will pay cleanup costs, and Kennedy officials said that they may pursue cost sharing in two. These cases involved a former landowner and a former lessee. In regard to the former landowner, Kennedy officials said that they will consider action against the former landowner of the Wilson Corners site, which involves groundwater contamination. To date, Kennedy has spent $1.1 million remediating this site and will spend $168,000 per year to pump and treat for the foreseeable future. In the case involving the former lessee, Kennedy plans to spend about $3.5 million to clean up fuel oil contamination at its visitor's center (Spaceport USA). Cleanup involves removing and aerating soil at the site. At the time of the contamination, the visitor's center was operated by a lessee. A storage tank leaked gas or diesel fuel and contaminated the soil. Kennedy officials believe that the lessee had control of the situation and should be held responsible. However, there is currently no cost sharing agreement in place. According to Kennedy officials, the former lessee paid for the remedial investigation at the site before Kennedy assumed control of the cleanup. Kennedy officials said that they took over the cleanup of the site because the lessee, which had operated the visitor's center, lost the lease to another company now operating the center. After the cleanup is completed, Kennedy will decide whether the former lessee will be asked to reimburse the government.

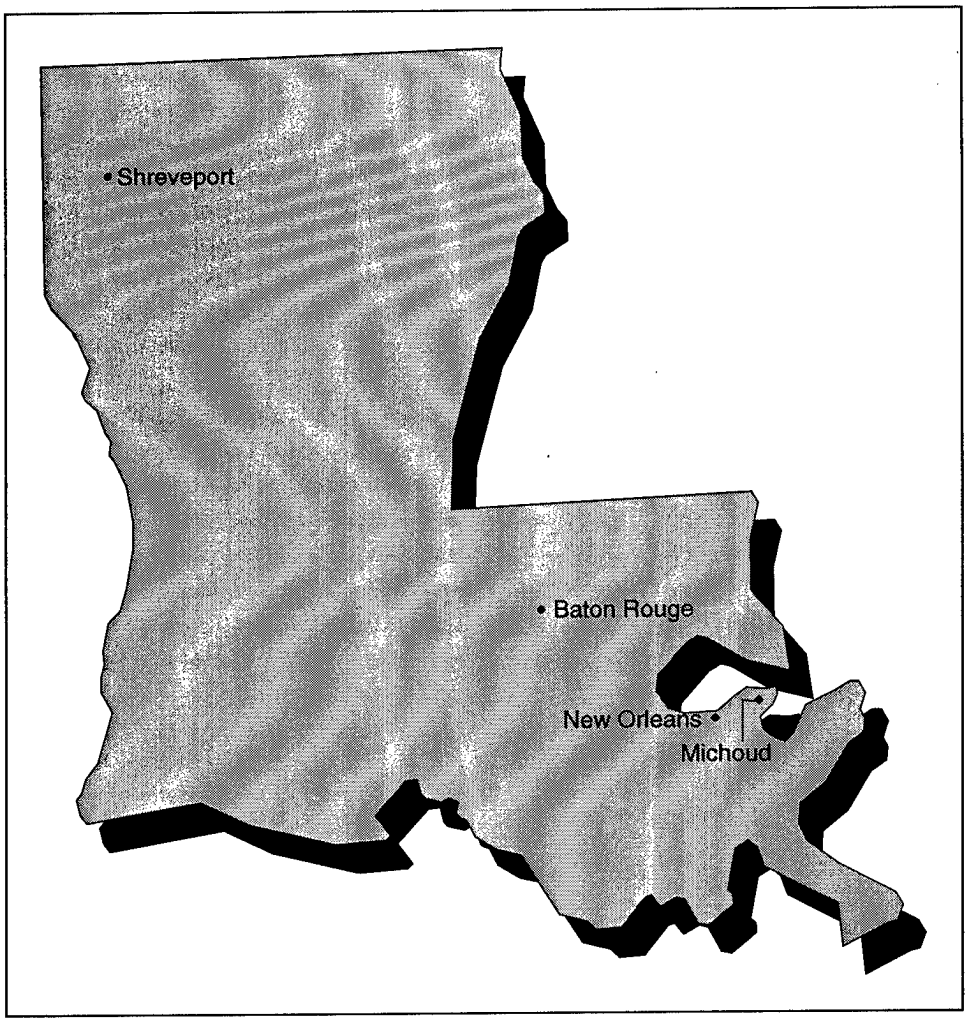
Michoud Assembly Facility

Background

Site Description and Mission

The Michoud Assembly Facility is a government-owned, contractor-operated component of the George C. Marshall Space Flight Center. The facility has been owned by NASA and operated by a contractor since its acquisition by NASA in 1961. Michoud is located in New Orleans, Louisiana, on about 830 acres of government-owned land (see fig. II.1).

Figure II.1: Location of the Michoud Assembly Facility



Source: NASA Real Property Locations by Accountable Reporting Installations.

Michoud's mission is to support the continuing development and operations of the NASA space shuttle program. Specifically, Michoud provides the design and assembly of the external tank for the space shuttle.

Regulatory Process

Contaminated sites at Michoud are being addressed under the RCRA corrective action process. On January 23, 1995, the remediation program, including all decision-making authority, was transferred to the state of Louisiana because the state received authorization from EPA to implement the RCRA program. EPA's current responsibility is to provide oversight to the state and to monitor the groundwater program.

Extent of Contamination

Contaminated Sites

As a manufacturing facility, past waste management disposal practices and accidents have contaminated Michoud's soil, surface water, and groundwater with trichloroethylene, volatile organic compounds, metals, diesel fuel, and other contaminants. According to Michoud officials and the operating contractor, it appears the vast majority of contamination resulted from NASA's Apollo program after the site was transferred to NASA in 1961. According to Michoud and the operating contractor, trichloroethylene in the groundwater presents the greatest risk, and the likely major cause of the groundwater contamination was a 16,000-gallon trichloroethylene spill that occurred in 1966. The contamination appears to be limited to the upper 45 feet of groundwater and soil in only a few areas.

The operating contractor first discovered environmental contamination at Michoud in November 1982. The RCRA facility assessment in August 1986 identified 57 potentially contaminated sites. According to the operating contractor, more detailed evaluations by the state and EPA determined 46 of these sites required no further action. The remaining 11 sites, plus two additional ones identified and 10 petroleum-related sites added by the regulators, comprise the 23 potential sites being investigated. NASA headquarters' March 1996 inventory of sites lists 33 sites for Michoud. Twenty of these are already closed sites (13); nonleaking, above-ground active petroleum storage tanks (4); or sites recommended for no further

action (3). The operating contractor was unable to reconcile individual differences between the NASA headquarters' inventory of sites and the 23 sites it is currently investigating.

Cleanup Status and Schedule

A phase II RCRA facility investigation report was sent to regulators for review and approval. A phase III and phase IV RCRA facility investigation will finish delineating the extent of contamination at areas not covered by the phase II RCRA. Phases III and IV may extend through 1999 and could include actions that range from implementing corrective measures that result in clean closure to monitoring contaminants to ensure containment within Michoud's boundaries. A corrective measures study will then be performed to identify cleanup alternatives and could be completed in 2001 or 2002. According to Michoud officials, they cannot estimate when remediation will be completed until they have negotiated cleanup standards with the state and EPA.

All of the areas suspected of being contaminated have been evaluated; therefore, the inventory for Michoud should be complete. The operating contractor does not currently plan to completely clean up about half of Michoud's contaminated areas because of the technical and/or economic impracticability of cleaning the contaminated groundwater to pristine condition. This plan is due to Michoud's dense nonaqueous phase groundwater contamination.[1] According to the operating contractor, a significant portion of the released trichloroethylene will remain in the soil at the end of all remediation activities. The operating contractor's cleanup strategy is subject to state approval.

Cost to Clean Up Contamination

NASA headquarters estimates that it will cost $54 million to clean up Michoud's contaminated sites, not including operations and maintenance. Michoud's operating contractor estimates it will cost $16.5 million, not including long-term operations and maintenance or costs prior to 1988. Different estimating methodologies were used to develop the estimates. If all Michoud sites were required to be cleaned to the highest standard, the operating contractor noted it could cost over $800 million.

Historical Costs

For fiscal year 1988 through fiscal year 1995, Michoud received $6.5 million in construction of facilities funds for remediation activities, of

[1]According to EPA, dense nonaqueous phase liquids often are difficult to locate and remove from the subsurface. Their ability to sink through the water table and penetrate deeper portions of aquifers is one of the properties that makes them very difficult to remediate.

which $1.9 million was used for investigations or studies and $4.6 million was used for cleanup activities. All remediation and related projects since 1988 have been funded out of NASA's construction of facilities budget and have been directly charged to Michoud's operations contract. According to the operating contractor, NASA's external tank operations budget was used to fund all remediation activities from 1982 to 1988 and costs associated with these activities cannot be segregated in accounting records.

Future Costs

The operating contractor's total cost estimate of $16.5 million is about 70 percent lower than NASA headquarters' estimate of $54 million. According to a Michoud official, NASA headquarters' estimate could be overstated because it was developed using parts of a DOD cost model that treats contaminated sites at different locations the same regardless of their size or extent of contamination.

From fiscal year 1996 to fiscal year 2003, the operating contractor estimates that remediation activities will cost $10 million, but this amount does not include long-term operations and maintenance costs. According to the operating contractor, operation and maintenance of all remedial systems will continue throughout the external tank program at Michoud and costs cannot be accurately estimated. However, the operating contractor's risk-based assumptions used in preparing the estimates were all subject to state approval.

It is unknown whether future funding levels will be a problem, according to the operating contractor. Requirements and cleanup standards are currently unclear and will likely result in increased funding needs. According to a Michoud official, the estimated cost to complete remediation will depend heavily on the results of the RCRA facility investigation, the corrective measures study, the corrective measures plan, and the mandated cleanup standards.

In addition to remediation costs, Michoud reimburses the state of Louisiana for the cost of regulating its hazardous and solid waste, as well as its groundwater program. Michoud paid the state $28,500 in 1995 for a total of approximately $200,000. EPA is not reimbursed for its work. Because off-site contractors have not worked for Michoud, it will not incur any additional costs for cleanup at contractor-owned locations.

Cost Sharing Efforts

There are no cost sharing agreements in place for cleanup activities at Michoud. According to Michoud officials, remediation efforts are primarily addressing contamination from government activities from the early 1960s. To determine the potential of recovering environmental remediation costs (either from contractors or insurance companies), Michoud officials searched for copies of contracts and insurance policies for three contractors that operated at Michoud during the 1960s. At the time the 16,000-gallon trichloroethylene spill occurred, Michoud officials said that the Boeing Corporation was the operating contractor. An April 1993 memorandum shows that Michoud could not find the contracts or insurance policies. NASA has not conducted similar searches for the current production contractor because the majority of the contamination existed before the contractor came on site.

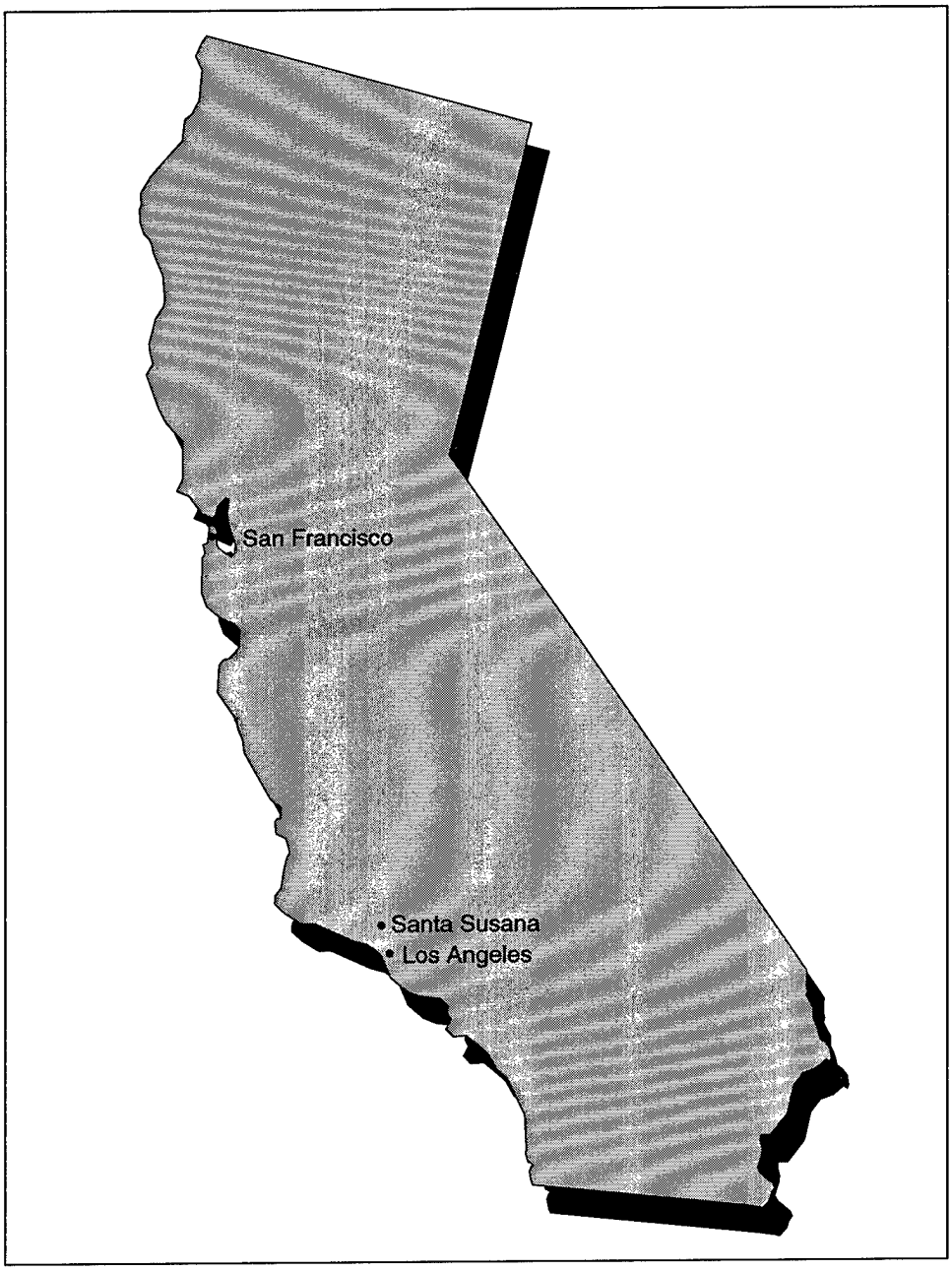
Santa Susana Field Laboratory

Background

Site Description and Mission

The Santa Susana Field Laboratory occupies about 2,700 acres in the southeast corner of Ventura County, California, about 29 miles northwest of Los Angeles near the crest of the Simi Hills (see fig. III.1).

Figure III.1: Location of the Santa Susana Field Laboratory



Source: NASA Real Property Locations by Accountable Reporting Installations.

Most of the land adjacent to the Santa Susana facility is undeveloped mountainous land. The nearest residential developments are located about a mile from the facility. There are a few acres of avocado orchards and one apiary; both are on private property immediately adjacent to the facility.

Since 1947, Santa Susana activities have included research, development, and testing of rocket engines, water jet pumps, lasers, liquid metal heat exchanger components, nuclear energy, fossil fuel projects, and related technologies. The principal activity has been the testing of large rocket engines. Six major liquid rocket engine test areas operated simultaneously in the late 1950s and early 1960s.

Organization

Rockwell International Corporation, Seal Beach, California (formerly North American Aviation), has been the sole-operating contractor at Santa Susana since the facility was established. It currently operates the facility, primarily for NASA.

Since 1958, the federal government, first the Air Force and since 1972 NASA, has owned a portion of the facility. NASA's Marshall Space Flight Center is responsible for overseeing the environmental remediation activities on the NASA-owned property at Santa Susana. Rockwell, as part of its operating contract with NASA, is responsible for

- preparing environmental work plans;
- negotiating with the California Department of Toxic Substances Control and EPA regulators;
- preparing overall status and groundwater monitoring reports;
- awarding subcontracts to perform studies and interim corrective measures;
- overseeing subcontractor performance; and
- maintaining all cleanup-related records, including cost records for the NASA-owned property at Santa Susana.

Rockwell subcontracts studies and investigations, interim corrective measures, and water sampling and maintenance of monitoring wells.

Rockwell deals with environmental issues related to the property it owns as well. Environmental expenses related to its property are passed to NASA as well as other customers—primarily DOD and the Department of Energy—through overhead charges on contracts it has with them.

Regulatory Process

Santa Susana is subject to the RCRA corrective action process. Under RCRA, EPA has authorized the California Department of Toxic Substances Control to manage the hazardous waste and corrective action programs in California. Since Santa Susana is an operating site, the Department of Toxic Substances Control has the lead agency role in regulating the site, and it reviews and approves the work plans for the proposed investigation and remediation procedures. The Los Angeles Regional Water Quality Control Board is also involved on an advisory basis.

Extent of Contamination

Contaminated Sites

Environmental contamination was first identified at the Santa Susana facility when Rockwell found trichloroethylene during an investigation of site water wells in 1984. Rockwell notified the water board about the detected groundwater contamination, and the board requested that Rockwell further investigate the water quality and hydrogeologic conditions at Santa Susana. In response, Rockwell initiated a phased investigation. Based on Rockwell's preliminary characterization efforts, the board recommended implementing interim remedial measures for the contaminated groundwater.

EPA conducted a RCRA facility assessment in 1990 of the entire Santa Susana facility and identified a number of potentially contaminated sites. The Department of Toxic Substances Control issued a stipulated enforcement order to Rockwell on November 12, 1992, requiring that it prepare a draft RCRA facility investigation work plan. Rockwell submitted a work plan to the Department of Toxic Substances Control for its review in March 1995.

Santa Susana has a number of specific potentially contaminated sites, but the overriding contamination problem is the trichloroethylene contamination of the groundwater that encompasses a large portion of the facility. The RCRA facility investigation work plan, dated March 1995, identifies 82 potentially contaminated sites and areas of concern for all areas of Santa Susana. NASA headquarters' March 1996 inventory for the NASA-owned property lists 2 petroleum sites and 33 contaminated sites. The remaining sites (47) are on Rockwell-owned property.

Historically, the principal use of trichloroethylene was to decontaminate the large engines to prevent the risk of explosion during testing. About 97 percent of the trichloroethylene was released from 1954 through 1961. In 1961, Rockwell began reclaiming trichloroethylene. Most trichloroethylene has been reclaimed at all large test areas. Except for one test area, the use of trichloroethylene at the site was discontinued in 1977. A reclamation system for used trichloroethylene is currently maintained at this test area. DOD was Rockwell's principal customer prior to 1961 with such programs as the Navaho, Atlas, Jupiter, and Thor rocket engines. A 1993 records search and trichloroethylene release assessment report prepared by a contractor for NASA stated that 530,358 gallons of trichloroethylene were released to the ground at Santa Susana.

Cleanup Status and Schedule

The current remediation status of the 35 NASA-owned sites at Santa Susana is shown in table III.1.

Table III.1: Remediation Status of NASA-owned Sites

Status	Number
Investigating	14
No further action	11
Monitoring	5
Closed	2
Other	3
Total	**35**

The Department of Toxic Substances Control has not yet agreed to the no further action decision for the 11 sites. Rockwell officials were not sure whether additional sites will be identified. Some of the groundwater contamination migrated off site to the north and northeast, and Rockwell is monitoring and will decide what actions are required.

While Santa Susana has soil and surface water contamination, the groundwater contamination is the major concern and, accordingly, is the focus of Rockwell's efforts. After detecting trichloroethylene in water samples from water supply wells in 1984, a phase I investigation was conducted to develop a plan for field investigations. Field investigations, including well construction, water sampling, photogeologic assessment, and well testing, were conducted in the phase II groundwater investigation. Groundwater conditions at the facility were evaluated based on data compiled from 231 wells that included 202 monitoring wells

constructed at or adjacent to the facility, 13 facility water supply wells, and 16 private off-site wells and springs.

A groundwater reclamation system began operating at the facility in 1987 to extract degraded groundwater and to minimize the off-site movement of degraded water by modifying and controlling groundwater gradients. A contractor report stated that about 138 gallons of volatile organic compounds (mostly trichloroethylene) were removed through groundwater treatment operations for fiscal year 1988 through the first quarter of 1996.

After Rockwell completes the RCRA facility investigation, it plans to perform a corrective measures study to recommend the final corrective action(s). A Rockwell official estimates that the corrective measures study will begin in late 1997 to early 1998.

Cost to Clean Up Contamination

Historical Costs

Through fiscal year 1995, a total of $21.1 million—$15.6 million by NASA and $5.5 million by others, including DOD—had been spent or authorized to clean up Santa Susana through direct and indirect overhead charges. NASA pays either directly for cleanup costs on the property it owns or through overhead charges for the property owned by Rockwell.

For direct charges, NASA headquarters authorized $6.2 million in construction of facilities funds for remediating groundwater in the NASA-owned portion for fiscal years 1990 through 1995. In addition, it authorized $1.5 million of construction of facilities funds that were designated as RCRA corrective action for (1) soil cleanup and closure and (2) decontamination of surface impoundments in area II and the NASA-owned portion of area I.

For fiscal years 1983 through 1995, Rockwell included $13.4 million in overhead charges for study and remediation costs primarily for groundwater in areas I and III. NASA paid $7.9 million of this total, DOD paid $1.7 million, and others, including the Department of Energy, paid the remainder.

For fiscal year 1996, NASA authorized $1 million in construction of facilities funds for groundwater remediation and $900,000 for RCRA corrective action of soil and surface impoundments.

Future Costs

Based on the portions of the DOD cost model that NASA used to project cleanup costs, NASA headquarters estimates that it will cost $93 million to clean up the contaminated sites on the NASA-owned property at Santa Susana, exclusive of the operations and maintenance cost to run the pump and treat system for groundwater remediation. In contrast, Rockwell estimates cleanup costs at $11.1 million, of which $9.6 million has already been obligated or spent. Neither estimate includes the operation and maintenance costs of the groundwater reclamation system for fiscal years 1997 through 2037, which NASA estimates at $58.5 million.

Rockwell estimates it will pass on $7.2 million through overhead charges for the portion of Santa Susana that it owns. Based on current contracts, NASA expects to pay $4.4 million, or about 60 percent, of this total. However, Rockwell will not estimate costs beyond the year 2000, significantly understating the amount NASA will have to pay through overhead charges.

Cost Sharing Efforts

At this time, no final arrangements have been made for the current and past owners or operators of Santa Susana to share costs. The portion of Santa Susana that NASA currently owns is considered a "formerly used defense" site. Therefore, the Corps of Engineers, Omaha District, tried to determine how the liability for environmental cleanup should be divided among NASA, Rockwell, and DOD.

In April 1989, Rockwell requested authorization for a defense environmental restoration project that would be funded through the DOD defense environmental restoration program. The Corps of Engineers is representing DOD in evaluating Rockwell's request, and it used a contractor to investigate the environmental contamination at the facility. The study concluded that Rockwell was responsible for 92 percent of the groundwater contamination, while the Air Force and NASA were each responsible for 4 percent. In a January 7, 1990, memorandum to Rockwell, the Corps concluded that Rockwell activities at the site failed to comply with the applicable requirements of the national oil and hazardous substances pollution contingency plan. Therefore, the Corps decided any

past or future costs incurred by Rockwell cannot be reimbursed from DOD's defense environmental restoration program.

Since the Corps of Engineers' decision, Rockwell, NASA, and the Corps have been discussing the cleanup situation and potential liability, and NASA has been paying the cleanup costs on the NASA-owned property. A NASA-funded study concluded that most of the groundwater contamination could be attributed to DOD. The NASA study showed that 88 percent related to DOD and 12 percent related to NASA. In a November 9, 1994, letter, NASA's counsel said that NASA disagreed with the Corps. NASA believes it has been paying a much larger portion than is fair and equitable. Also, NASA believes DOD should have a larger share of the liability.

In a March 3, 1995, memorandum to NASA, the Corps stated that although NASA and DOD support a three-party agreement, it is not confident that Rockwell is willing to participate in an agreement. Further, the Corps stated that if Rockwell is unwilling to either enter into such an agreement or provide adequate assurances that it will not seek cost sharing later, it is appropriate for NASA as a current landowner to take the legal action to involve Rockwell in the agreement.

Corps officials said that they have not recently discussed the cost sharing issue with NASA. Marshall Space Flight Center officials, who are responsible for managing the NASA parcels of the Santa Susana facility, said that they elevated further negotiations to NASA headquarters in a March 21, 1995, letter. NASA headquarters has reviewed the case and given some input to Marshall relative to the case. Marshall requested NASA's Inspector General to review the case, and the Inspector General is in the process of conducting a review.

Scope and Methodology

We reviewed applicable laws and regulations, but we did not independently determine compliance with laws or the merits of cost sharing at individual facilities. We also reviewed policies, procedures, and documents, including NASA databases on potentially contaminated sites. We used NASA's March 1996 inventory to determine the extent of contamination and the status of cleanup. While there was an update during our field work, we did not believe the update significantly changed the March 1996 data.

We also interviewed officials and reviewed supporting documentation at NASA and EPA headquarters in Washington, D.C., and at selected NASA field facilities throughout the country to obtain data on cleanup costs. The field facilities visited were

- Ames Research Center, Moffett Field, California;
- George C. Marshall Space Flight Center, Huntsville, Alabama;
- Jet Propulsion Laboratory, Pasadena, California;
- John C. Stennis Space Center, Mississippi;
- John F. Kennedy Space Center, Florida;
- Langley Research Center, Hampton, Virginia;
- Michoud Assembly Facility, New Orleans, Louisiana;
- NASA Industrial Plant, Downey, California; and
- Santa Susana Field Laboratory, Ventura County, California.

To obtain supplemental information, we sent data collection instruments to the other NASA field facilities and 20 of NASA's largest contractors. Table IV.1 lists the NASA facilities and the 16 contractors that responded to our request.

Table IV.1: Locations and Organizations Responding to Our Data Request

Location	Organization
NASA	Dryden Flight Research Center, Edwards, California
	Goddard Space Flight Center, Greenbelt, Maryland
	Lewis Research Center, Cleveland, Ohio
	Lyndon B. Johnson Space Center, Houston, Texas
	Wallops Flight Facility, Wallops Island, Virginia
	White Sands Test Facility, Las Cruces, New Mexico
Private contractor	Allied Signal, Inc., Morriston, New Jersey
	BAMSI, Inc., Titusville, Florida
	Boeing Company, Seattle, Washington
	CAE Link Corporation, Binghamton, New York
	Computer Sciences Corporation, El Segundo, California
	EG&G Florida, Inc., Florida
	General Electric Company, Inc., Fairfield, Connecticut
	GM Hughes Electronics Company, Los Angeles, California
	Lockheed Martin Corporation, Bethesda, Maryland
	Loral Corporation, New York, New York
	McDonnell Douglas Corporation, Saint Louis, Missouri
	Northrop Grumman Corporation, Los Angeles, California
	Rockwell International Corporation, Seal Beach, California
	Thiokol Corporation, Odgen, Utah
	TRW, Inc., Cleveland, Ohio
	United Technologies Corporation, Hartford, Connecticut

Starting in fiscal year 1998, federal accounting standards will require liability estimates for hazardous materials such as mission equipment rockets, launchers, and space exploration equipment. We did not examine NASA's potential liabilities for such mission equipment in this review.

Comments From the National Aeronautics and Space Administration

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

See pp. 18-19.

See pp. 18-19.

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001

MAY 16 1997

Mr. David R. Warren
Director, Defense Management Issues
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Warren:

We have reviewed the General Accounting Office (GAO) Draft Report, "NASA Environmental Cleanup Costs: NASA Making Progress in Identifying Contamination, More Effort Needed," which was provided via your letter of April 14, 1997, to NASA Administrator Daniel Goldin. NASA has already implemented the recommendations for estimating probable future costs by identifying site-specific costs, prioritizing the application of cleanup funds in NASA's cleanup program, and developing a policy statement concerning potentially responsible parties. NASA concurs with the recommendation to establish facility-based, implementation schedules for completing cleanup of contaminated sites. With respect to the recommendation to estimate probable future costs for facility closures, NASA prefers that the recommendation be limited to facilities that are currently being considered for closure. NASA recommends deleting the recommendation to require contractors to provide remediation cost estimates for cleaning up contamination at contractor facilities.

Enclosed are NASA's comments to the GAO draft report. We appreciate the opportunity to provide comments on the draft report.

Sincerely,

J. R. Dailey
Acting Deputy Administrator

Enclosure

NASA Comments to Draft GAO Report, "NASA Environmental Cleanup Costs: NASA Making Progress in Identifying Contamination, More Effort Needed"

General Comments:

Now on pp. 10-12.
See comment 1.

1. The report includes cost data in several locations, including pages 11-13 and Appendices I, II, and III. The new cost model which is noted in the report, provides significantly improved cost estimates, particularly for the NASA Centers. NASA's Environmental Management Division can provide the new cost information.

Now on pp. 4 and 6.
See comment 2.

2. Page 3, Results in Brief, first sentence, page 6, Extent of Contamination, second paragraph, and page 7, third paragraph: Statements to the effect that NASA did not commence a comprehensive site-identification effort until 1993 are misleading. NASA initiated a comprehensive effort to identify its contaminated sites in 1988, with establishment of the Environmental Compliance and Restoration program as part of the Construction of Facilities budget. This program addresses environmental cleanup and compliance requirements of the various environmental laws, including the Superfund Amendments and Reauthorization Act of 1986 (SARA) which directed Federal agencies to identify contaminated sites and conduct cleanups. NASA completed its initial preliminary assessments and site inspections to identify its sites in 1990 within the timeframe established by SARA. The 1993 date represents development of the Hazardous Waste Site Inventory database which compiled the site data collected in the preliminary assessments, site inspections, and follow up studies into an automated tool for easy access and tracking.

Now on p. 8.
See comment 2.

3. Page 8, first paragraph, last sentence: NASA only has a "choice" in following RCRA or CERCLA when there is no RCRA permit and the facility is not a Superfund-listed site. For facilities with RCRA permits, the standard approach of both EPA and the states are to conduct the cleanups under RCRA. States often do not regulate under CERCLA at RCRA permitted facilities. All of the NASA facilities where cleanup is being conducted under RCRA have RCRA permits.

Now on p. 11.
See comment 1.

4. Page 11, second paragraph: With the new cost model, NASA has developed a cost estimate for all of the sites expected to require future action. NASA's Environmental Management Division can provide you with the new cost information so that the paragraph can be updated.

Now on p. 11.
See comment 3.

5. Page 12, third paragraph: The new cost estimate includes at least 5 years of Operation and Maintenance (O&M) for sites which are likely to require O&M.

Now on p. 42.
See comment 4.

6. Page 46, last sentence: NASA Headquarters has not assumed responsibility for dealing with the U.S. Army Corps of Engineers at the Santa Susana Field Laboratory but has coordinated several early meetings and will continue to support Marshall Space Flight Center's efforts to involve the Corps. Pursuant to the draft NASA Procedures and Guidelines (NPG) 8850, the NASA Centers will generally be responsible for conducting negotiations with potentially

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responsible parties, and NASA Headquarters will coordinate with the Department of Justice and concur on proposed settlements. NASA Headquarters could provide support to the Centers upon request but would not normally assume the lead role for negotiations.

Comments to the GAO Recommendations:

See pp. 18-19.

RECOMMENDATION: Establish facility-based, implementation schedules for completing cleanup of contaminated sites.

RESPONSE: We concur with the recommendation and view it as the logical next step in the cleanup process. However, we wish to point out that any schedule developed prior to regulatory approval needs to be considered tentative.

RECOMMENDATION: Estimate probable future costs by (1) identifying all site-specific costs, including operation and maintenance costs for sites believed to require remediation, (2) requiring its contractors to provide remediation cost estimates for cleaning up contamination at contractor facilities that could represent future costs for NASA, and (3) identifying infrastructure changes such as planned property use and applicable cleanup standards, and documenting the impact of facility closure decisions on environmental cleanup costs; and prioritizing of environmental funds in its cleanup efforts.

This recommendation consists of four components that address four separate issues. Therefore, we have divided the recommendation into its four components and have responded to each component individually.

RECOMMENDATION: Estimate probable future costs by identifying all site-specific costs, including operation and maintenance costs for sites believed to require remediation.

See pp. 18-19.

RESPONSE: With the new cost model, NASA has developed a cost estimate for all of the sites believed to require remediation, including operation and maintenance. The new cost estimate of $1.4 billion has been reviewed by auditors and has been reported in NASA's "Fiscal Year 1996 Accountability Report." This cost estimate will be updated annually to include more detailed site information as it becomes available. We believe that this addresses the recommendation.

See pp. 18-19.
See comment 5.

RECOMMENDATION: Estimate probable future costs by requiring contractors to provide remediation cost estimates for cleaning up contamination at contractor facilities that could represent future costs for NASA.

RESPONSE: This recommendation involves estimating contractor cleanup costs to be allowed as indirect costs to Government contracts. Such cleanup costs at contractor owned and operated facilities are allowable only to the extent permitted by contract laws and regulations, which are standard across Government procurements. Although certain of these costs may eventually be considered allocable and allowable in accordance with

the Cost Accounting Standards and applicable cost principles, the amount to be allocated to each of the contractor's customers, including NASA, would be speculative. Also, it is not clear that we can require contractors to report cleanup costs not relevant to current contracts. Therefore, we recommend deleting this recommendation.

RECOMMENDATION: Estimate probable future costs by identifying infrastructure changes such as planned property use and applicable cleanup standards and documenting the impact of facility closure decisions on environmental cleanup costs.

See pp. 18-19.

RESPONSE: We do believe that environmental costs need to be identified as early as possible when facilities are initially being considered for closure. At that time, issues regarding future land use and condition of facilities become better defined. The NASA Headquarters Environmental Management Division, along with the Center Environmental Offices, need to be involved early in the process to identify environmental issues and costs related to closure of facilities. We believe this needs to be on a facility-specific basis when closure is initially being considered. We would concur on a recommendation of this nature.

See comment 6.

The recommendation, as currently written, goes well beyond the requirement to identify remediation cleanup liabilities for reporting in the Annual Accountability Report which currently reports costs associated with remediation of past hazardous waste sites and petroleum tanks and spills on all facilities. The cost estimate is updated annually as it needs to be, based on the best data available and generally assumes continuation of current land use.

The environmental costs associated with closure of a facility may need to consider other environmental issues in addition to those reported in the Annual Accountability Report, such as the National Environmental Policy Act, the National Historic Preservation Act, asbestos, PCB transformers, condition of sewers and treatment facilities, and condition of plating shops and other industrial facilities. The requirements for closure of these facilities will depend on a number of factors such as future facility usage, facility and equipment maintenance, and changes in technology. Such an effort undertaken with regard to all facilities, even those not being considered for closure, would be time consuming and expensive. The data would be out of date in a short time period or could change significantly for different land use scenarios. Therefore, we do not believe the recommendation is reasonable to implement Agencywide for all facilities.

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See pp. 18-19.

RECOMMENDATION: Prioritizing the application of cleanup funds in NASA's cleanup efforts.

RESPONSE: NASA has established an Environmental Compliance and Restoration program which provides cleanup funds exclusively for environmental compliance and restoration requirements. Requests for funding of new projects follow a six-step process:

1. Projects are prioritized, based on the Environmental Protection Agency's classification system which divides projects and activities into five classes.
2. Proects are categorized by environmental cost type.
3. Projects are evaluated and validated based on Agencywide impacts and requirements.
4. Projects are coordinated with the Centers and the Institutional Program Offices.
5. Unsupported requests are assessed for impact to Agency and Center programs.
6. A Center's capability to implement the program is considered.

We believe this addresses the recommendation.

See pp. 18-19.

RECOMMENDATION: Issue a policy statement concerning potentially responsible parties and cost recovery.

RESPONSE: NASA has developed a draft NASA Procedures and Guidelines (NPG) 8850, "Environmental Investigation and Remediation - Potentially Responsible Party Identification and Analysis," which has been circulated for review and comment to the NASA Program Offices and Centers. We anticipate NPG 8850 to be issued by June 1997.

The following are GAO's comments on NASA's letter dated May 16, 1997.

GAO Comments

1. Our report recognizes that NASA has updated the information on cleanup costs by using a new cost model that includes a cost for each site believed to require cleaning up. The cost information developed using the new model, however, is not complete because 90 additional sites are to be added. Also, most sites are still being investigated by the NASA field facilities. Because the new model's interim cost data total only about 10 percent less than the prior cost data and additional sites will be added, we did not change the cost information in the report. Cost information shown in our appendixes was gathered directly from NASA's field facilities and was not related to either the new or old model.

2. We revised our report to more clearly identify NASA's actions and status.

3. We included footnote 10 in the report text to recognize that the new cost model will include at least 5 years of long-term operation and maintenance costs for applicable sites.

4. We updated the information in appendix III to reflect the most current status of the Santa Susana case.

5. We modified the recommendation to state that NASA should obtain the necessary information.

6. NASA's stated position is consistent with the intent of our recommendation. We do not go beyond the requirement stated by NASA to identify remediation cleanup liabilities for reporting. We recommended identifying infrastructure changes and associated cost impact, such as for changes planned at the Downey facility. We did not intend to recommend identifying changes that are not planned, so we modified our recommendation to make this distinction clear.

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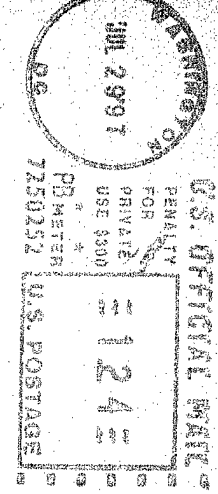
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