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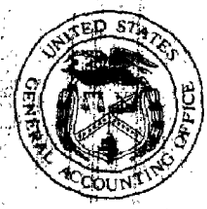
United States General Accounting Office

Report to the Congress

June 1990

NUCLEAR WASTE

Changes Needed in DOE User-Fee Assessments to Avoid Funding Shortfall



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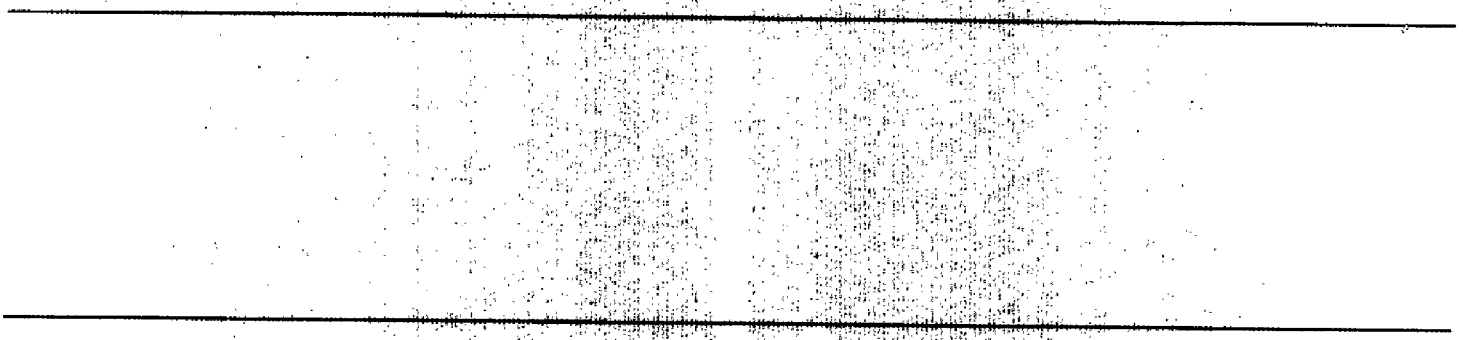

GAO

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

Comptroller General
of the United States

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June 7, 1990

To the President of the Senate and the
Speaker of the House of Representatives

This report presents the results of our fifth annual audit of the Department of Energy's efforts to implement the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101), as amended by Title V of the Omnibus Budget Reconciliation Act of Fiscal Year 1987 (P.L. 100-203). The act requires us to report to the Congress the results of an annual audit of the Department's Office of Civilian Radioactive Waste Management.

We are sending copies of this report to congressional committees with oversight of the Department's activities, the Secretary of Energy, and other interested parties.

This work was performed under the direction of Victor S. Rezendes, Director of Energy Issues, Resources, Community, and Economic Development Division. Other major contributors are listed in appendix III.

Charles A. Bowsher

Charles A. Bowsher
Comptroller General
of the United States

Executive Summary

Purpose

The Department of Energy (DOE) estimates that disposing of highly radioactive waste from civilian nuclear power plants and its defense-related nuclear facilities could eventually cost $32 billion (in constant 1988 dollars). To pay these costs, DOE must collect sufficient fees from utilities on electricity generated by nuclear power plants and make payments from its defense appropriation. In this fifth annual report, required by the Nuclear Waste Policy Act of 1982, GAO discusses the reasonableness of the methods and assumptions DOE uses in periodically estimating waste program costs and revenues and deciding if fees should be adjusted.

Background

The 1982 act directed DOE to develop one repository for permanent disposal of wastes produced by civilian nuclear power plants. DOE will also dispose of its high-level wastes in the repository. In December 1987 the Congress amended the act and directed DOE to stop investigating all potential first-repository sites except Yucca Mountain, Nevada; terminate the search for a second repository; and report on the need for a second repository in about 20 years.

The waste program is financed through annual appropriations from the Nuclear Waste Fund. Each quarter, utilities pay a fee of 0.1 cent per kilowatt-hour of nuclear-generated electricity into the Fund. In return, utilities are relieved of further financial obligation for waste disposal. DOE is also required to pay its fair share of program costs.

Each year DOE is required to determine if the civilian-waste fee is adequate to recover all applicable program costs. DOE did not, however, make the 1988-89 determinations. In assessing fee adequacy, DOE estimates program costs, fee collections, interest earnings, and Fund balances through the program's end. DOE does this using a variety of assumptions, such as the number and locations of repositories and the amount of electricity (and waste) to be generated. DOE has not proposed a change in the fee since the program began.

Results in Brief

Unless careful attention is given to its financial condition, the nuclear waste program is susceptible to future budget shortfalls. Without a fee increase the civilian-waste part of the program may already be underfunded by at least $2.4 billion (in discounted 1988 dollars). Also, DOE has not paid its share—about $480 million—of costs, nor has it disclosed this liability in its financial records.

Sound fiscal management requires reliable cost and revenue estimates that recognize inherent program uncertainties. Although DOE has improved its cost estimates, the estimates do not adequately recognize program uncertainties. Indexing the civilian fee to the inflation rate would address one major cost uncertainty. DOE intends to do this at an appropriate time; however, it does not use a realistic rate of inflation as its most probable scenario in assessing whether that time has arrived. Also, legislation would be required to implement an inflation indexing system.

GAO's Analysis

Potential Funding Shortfall

The nuclear waste program is susceptible to future budget problems. The fee paid by utilities must provide sufficient revenues to cover total program costs because DOE cannot adjust the fee retroactively. Thus, if costs eventually exceed revenues, the shortfall will have to be financed by either (1) charging those utilities still operating nuclear plants disproportionately high disposal fees, (2) federal appropriations, or (3) a combination of the two.

When DOE expects to begin operating a repository at Yucca Mountain in 2010, many nuclear plants will be approaching the end of their 40-year lives. Unless new plants are built or the lives of existing plants are extended, the number of nuclear plants will begin to decline and fee collections will decrease. Under present law, the utilities operating the remaining plants would have to pay higher fees if, at the time, DOE found that program costs would exceed revenues. If adequate funding is not provided, the Congress might have to authorize the use of general tax revenues to fund a part of the program's cost.

Reliability of Cost Estimates

Considering the program's unique nature and early stage, DOE's cost estimates are becoming more complete and reliable, in part because program requirements are better defined. For example, DOE's plan for investigating Yucca Mountain recently became available for use in estimating costs. Also, DOE recently included some major cost elements omitted from earlier estimates.

Improved estimates and changes in scope resulted in a real increase in the program's estimated cost of about $8 billion. The estimates still do

not, however, fully recognize future program uncertainties. For example, program development and evaluation costs, one of the largest single cost categories, does not contain a contingency allowance. But the program's cost-growth history and the uncertainties that must be considered in estimating costs over the program's life, argue for a liberal, system-wide contingency allowance in the estimates. In addition to inflation, major uncertainties include schedule delays and the number of repositories needed.

Insufficient Weight Given to Inflation

DOE's analyses of fee adequacy show that various rates of inflation over the program's life would have wide-ranging effects on projected final Fund balances. This occurs because inflation directly affects program costs—it has already added about $4.5 billion to the program's estimated cost. However, the disposal fee that utilities pay is not adjusted for inflation.

DOE estimates costs in constant dollars and then applies various inflation rates to the estimates in analyzing fee adequacy. Its objective is to determine when an inflation indexing system should be implemented. DOE's 1987 assessment and a February 1989 independent internal assessment show that the current fee is inadequate unless little or no inflation occurs over the program's life, an unlikely event. The independent estimate shows that without a fee increase the Fund may already be underfunded by $2.4 billion to $4.1 billion (in discounted 1988 dollars).

In view of the program's length and uncertainty in both real and inflation-related costs, indexing the fee to the rate of inflation is a way of protecting the Fund from the effects of inflation. However, DOE did not select an inflation rate representing the most probable future scenario as a base case in determining when indexing should begin. Thus, the basis for its conclusion was not clear. The use of a realistic, base-case inflation rate would help put the varying inflation rate scenarios analyzed into better perspective, thereby making DOE's fee-adequacy determination clearer. Although DOE officials said the 1990 fee-adequacy report will more clearly explain their assessment methodology, they do not intend to use a base-case inflation-rate estimate.

DOE Not Paying Its Share

DOE has not begun paying its share of program costs, estimated at $3.6 billion to $6.4 billion depending on the number of repositories developed. The amount owed the Fund through September 30, 1989, is estimated at $483 million, including interest, but DOE has not recognized this

liability in its financial records and reports. DOE is considering paying its share of costs each year and paying off prior year costs (plus interest) over a 10-year period.

In reaching funding decisions, the administration and the Congress must consider competing demands for funds, including those needed to clean up DOE's nuclear weapons complex. Of critical importance to future defense-waste fee-payment decisions is formal reporting of DOE's cost share so that administration and congressional decision makers understand the implications of alternative fee-payment decisions.

Recommendation to the Congress

GAO recommends that the Congress amend the Nuclear Waste Policy Act to authorize the Secretary of Energy to automatically adjust the civilian nuclear waste disposal fee on the basis of an inflation index.

Recommendations to the Secretary of Energy

GAO makes several recommendations to the Secretary of Energy aimed at further improving DOE's methods for estimating program costs and determining the adequacy of civilian-waste disposal fees. (See chs. 2 and 3.) GAO is also recommending that the Secretary include statements of DOE's actual and contingent liabilities for its share of program costs in its financial and budget documents. (See ch. 3.)

Agency Comments

DOE agreed with the facts presented in GAO's report and with all but one of its recommendations. GAO is concerned, however, that DOE's planned corrective actions may not adequately insure against a future funding shortfall. For example, DOE agreed to study—not implement—GAO's recommendation that it provide adequate contingencies in all major cost categories. GAO will not be able to evaluate DOE's actions until DOE issues its next fee-adequacy report.

Contents

Abbreviations

CBO	Congressional Budget Office
DOE	Department of Energy
EIA	Energy Information Administration
GAO	General Accounting Office
GNP	gross national product
ICE	independent cost estimating
IG	Inspector General
KWH	kilowatt hour
MRS	monitored retrievable storage
MTU	metric tons of uranium
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982
OCRWM	Office of Civilian Radioactive Waste Management
RCED	Resources, Community, and Economic Development Division
TSLCC	total system life-cycle costs

Introduction

The Department of Energy (DOE) is responsible for developing and administering a comprehensive national program directed toward the safe and permanent disposal of spent nuclear fuel and other high-level radioactive wastes.[1] The Nuclear Waste Policy Act of 1982 (NWPA) (P.L. 97-425) requires that the owners and generators of the nuclear wastes pay the program's costs and establishes a fee-setting mechanism under which DOE must annually assess the adequacy of the disposal fee. NWPA also requires that we make an annual audit of DOE's Office of Civilian Radioactive Waste Management (OCRWM) which administers the program. In this report on our fifth annual audit, we discuss OCRWM's assessment process, including the development of program cost estimates and the process followed in deciding on whether the fee is adequate.

Establishment of Program

NWPA established the process and schedule to be followed by DOE in siting, constructing, and operating one or more deep underground repositories in which nuclear wastes are to be disposed. The act required constructing one repository and selecting a site for a second repository. In late 1987 DOE was preparing to characterize (investigate) three potential sites for the nation's first repository.[2] However, in response to mounting program opposition and costs, the Congress redirected the program through the Nuclear Waste Policy Amendments Act of 1987 (Amendments Act) enacted on December 22, 1987.[3] Most importantly, the Amendments Act designated one site (Yucca Mountain, Nevada) for characterization and required the termination of work on all other sites, including the search for candidate sites for the second repository. The Amendments Act also authorized DOE to site, construct, and operate a monitored retrievable storage (MRS) facility wherein the waste would be stored temporarily; however, certain conditions must be met.

NWPA gave the President an option as to whether or not DOE should dispose of its highly radioactive waste from national defense activities in the same repositories as commercial nuclear waste. In April 1985 the

[1]Spent nuclear fuel is the uranium fuel that has been removed from a nuclear reactor after it has been used to the extent that it is no longer useful in producing electricity.

[2]Site characterization refers to activities undertaken in either the laboratory or the field to study the geologic condition of a potential repository site. Such activities include borings, surface excavations, exploratory underground shafts, and testing at repository depth to evaluate the suitability of a site.

[3]The Amendments Act is contained in Title V of the Omnibus Budget Reconciliation Act of 1987 (P.L. 100-203).

President decided in favor of disposing of defense wastes with the commercial waste. In accordance with the act, the government must pay its fair share of the nuclear waste disposal program.

Program Financing

NWPA, as amended, requires that the nuclear waste disposal program's costs be fully recovered from the generators and owners of nuclear waste. The act also directed DOE to enter into contracts with utilities to begin accepting nuclear waste by January 31, 1998, and established the Nuclear Waste Fund—a separate fund in the Treasury—to finance the program. Utilities, through contracts with DOE, must pay annually into the Fund a user fee of 1 mill (one-tenth of a cent) per kilowatt hour (KWH) of electricity generated from their nuclear power plants since April 7, 1983. As applicable, they must also pay a one-time user fee for disposal of spent nuclear fuel they generated before that date. Payment of fees in accordance with DOE's fee collection arrangements relieves a utility of any further financial obligation for disposal of the related waste.

Regardless of the Fund balance, DOE can only obligate moneys from the Fund that have been appropriated by the Congress. Amounts that DOE determines are excess to current program needs are invested in U.S. obligations. If necessary, DOE is authorized to borrow from the U.S. Treasury. Table 1.1 shows the total fees collected, interest earned, and disbursements from the Fund through the end of December 1989.

Table 1.1: Status of the Nuclear Waste Fund as of December 31, 1989

Dollars in billions

Activity	Amount
Collections	
One-time fees	$1.452
Ongoing fees	2.728
Interest	.877
Total	**$5.057**
Disbursements	$(2.708)
Balance	**$2.349**

Source: DOE.

In a May 1989 report publicly released on September 25, 1989, DOE estimated that the program will cost between $23.8 billion and $32.7 billion (in constant 1988 dollars) depending on whether one or two repositories

will be built and on other assumptions.[4] The estimated cost of the program has been rising over the years at the same time that projections of the quantity of nuclear-generated electricity and thus, spent fuel, have been declining. DOE estimates that its fair share of the program's projected cost is $3.6 billion to $6.4 billion, depending on whether one or two repositories are eventually developed. This estimate is based on a formula established by DOE in August 1987 for allocating the cost of the nuclear waste program between civilian waste generators and DOE. DOE, however, has not paid any moneys into the Nuclear Waste Fund. On the basis of the formula, DOE estimates that it owed the fund about $483 million, including accrued interest, as of September 30, 1989.

Fee Assessment Process

The act requires that the Secretary of Energy annually review the amount of the fee established to determine whether revenues generated from the fee will be sufficient to offset the program's cost and, if not, to propose a fee adjustment to the Congress. As a part of its annual fee assessment, DOE estimates the costs of the waste management system over its complete life cycle. In addition to program cost estimates, DOE must project fee collections and interest earnings and/or expenses over the program life of about 100 years.

The act requires that if a revision to the fee is deemed necessary, DOE must immediately transmit its proposal to the Congress. Further, the proposed fee is to become effective after a period of 90 days unless either House of Congress disapproves it.[5] In the 6 years since the NWPA was enacted, DOE has not proposed a change in the fee.

In addition to preparing its cost analysis, DOE issues a report to the Congress summarizing its assessment of the fee and prepares a supplemental report providing a more detailed discussion of the assessment. DOE did not make the required annual assessment in 1988 or 1989. According to an OCRWM official, the assessment was not made because DOE was restructuring the program on the basis of the changes called for by the December 1987 amendments. Also, no assessment was issued in 1989

[4]Analysis of the Total System Life Cycle Cost for the Radioactive Waste Management Program (DOE/RW-0236, May 1989).

[5]The Supreme Court found unconstitutional other legislation providing for a legislative veto. In that instance, the Court ruled the legislative veto provision unconstitutional but left the remaining part of the act in tact. See Immigration and Naturalization Service v. Chadha, 462 U.S. 919 (1983).

because DOE needs to revise the 1989 cost estimate to reflect revisions to the program schedule announced on November 30, 1989.[6]

Program Cost Estimate

DOE's waste program cost estimates are comprised of five major cost categories:

- Development and evaluation.
- Transportation.
- Repository.
- MRS.
- Benefit payments to states and Indian tribes.

The development and evaluation category includes past, present, and future costs for siting, design development, testing, and regulatory and institutional activities associated with the repositories and the transportation system. This category also includes the total costs of administering the program and monitoring the waste and repositories through closure.

The transportation category includes the costs of purchasing, servicing, and maintaining shipping casks and of transporting the waste to DOE facilities.

The repository category includes costs for engineering, construction, operation, and closure and decommissioning of both surface and underground facilities. Within this category are costs for surface support facilities for security, fire protection, food service, administration, maintenance, and laboratories; waste-handling buildings; and underground shafts and ramps. Also included are costs for staffing, supplies, and utilities over the waste preparation and emplacement phase, the caretaker phase, and any subsequent period through the decommissioning phase. The latter phase involves permanently sealing the shafts and tunnels, decontaminating surface facilities, and returning the site to its natural state.

The cost of an MRS facility fully integrated into the system was first included in DOE's cost estimates in 1986. The types of costs included in the MRS category are generally similar to those described above for the

[6]Report to Congress on Reassessment of the Civilian Radioactive Waste Management Program (DOE/RW-0247, Nov. 1989).

repository except that the MRS does not include costs for underground facilities.

The Amendments Act also authorized DOE to enter into a benefits agreement with the state of Nevada concerning a repository at Yucca Mountain and with a state or Indian tribe concerning an MRS facility within the state or Indian tribe borders. To be eligible to receive the benefits, however, the state or Indian tribe must agree to waive its rights to veto the President's selection of a repository or MRS facility site and to waive any rights to impact assistance authorized by the NWPA. Benefit payments must be made in accordance with the schedule shown in table 1.2.

Table 1.2: Annual Benefits Payable to Host State

Dollars in millions

	Benefit amount	
Pay schedule	**MRS**	**Repository**
Annual payments prior to receipt of first spent fuel	$5	$10
Upon first receipt of spent fuel	10	20
Annual payments after receipt of first spent fuel until closure of the facility	10	20

Projection of Revenues

DOE's Energy Information Administration (EIA) projects the quantity of nuclear-generated electricity upon which the estimate of fee collections and nuclear waste quantities are based. Through the 1987 assessment, the EIA projection DOE used as its principal case, referred to as the upper-reference case, was derived from long-range forecasts of economic growth, energy demand (including electricity), and the projected nuclear power share of electrical generating capacity. This case assumed that utilities would begin constructing and operating new nuclear power plants by the turn of the century.

In an August 1987 report, we recommended that DOE base its program plans on projections of nuclear-generated electricity from plants licensed to operate and those plants that were under construction and expected to become operational.[7] DOE adopted our recommendation in making its cost estimate for 1989 and intends to follow the recommendation in its 1990 fee-adequacy assessment.

[7]Nuclear Waste: A Look at Current Use of Funds and Cost Estimates for the Future (GAO/RCED-87-121, Aug. 31, 1987).

Once fee collections are projected they can be used, along with estimated costs, to project annual interest earnings and expenses and end-of-year fund balances for each year through the end of the program's life. These projections are made for a number of different scenarios using various assumptions about key program elements. The disposal fee should produce a zero or near-zero balance in the Nuclear Waste Fund at the program's end.

Objectives, Scope, and Methodology

Our principal objective was to determine the reasonableness of the methods and assumptions used by DOE in making its annual assessments of the adequacy of the fees that commercial generators of nuclear waste pay into the Nuclear Waste Fund. We also reviewed issues related to payment of fees for disposal of defense waste. To address our principal objective we looked at the four major functions that DOE and its contractors perform in carrying out the assessment:

- Projecting nuclear generated electricity, with resultant projections used as a basis for estimating the amount of fees to be collected and the quantity of waste to be produced and disposed of in one or more repositories.
- Estimating total system life-cycle costs.
- Projecting interest revenues and end-of-year fund balances throughout the life of the program, based on various assumptions and scenarios.
- Assessing whether or not a fee revision should be proposed to the Congress.

The work performed in reviewing each of these four functions and in reviewing defense-waste fee issues is summarized in the following sections.

Projections of Nuclear Electricity Generation

EIA uses some sophisticated models in projecting electric generation needs; however, the models used in projecting electricity generation under the no-new orders case are fairly basic. We focused our review on the methodology followed in projecting electricity generation under the no-new orders case because this is the case DOE now uses for program planning purposes. Under this case, EIA projects the amounts of electricity that operating plants and plants expected to become operational will produce over their lifetimes. We reviewed the reasonableness of the methodology and assumptions used in arriving at projections under the no-new orders case by looking at such matters as estimated plant lives and the proportion of plant capacities used. Also, we met with officials

of EIA and OCRWM to discuss such matters as EIA assumptions, methodology, and input data.

Estimating Total System Life-Cycle Costs

In reviewing the adequacy of DOE's cost-estimating methodology, we used the following nine criteria which we identified in earlier work on major government acquisitions as basic to an effective cost-estimating process:

- Clear identification of task.
- Broad participation in preparing estimates.
- Availability of valid data.
- Standardized structure for estimates.
- Provision for program uncertainties (risks).
- Recognition of inflation.
- Recognition of excluded costs.
- Independent review of estimates.
- Revision of estimates when significant program changes occur.

These criteria are explained in appendix I.

In performing this review segment, we met with officials of DOE headquarters and field offices and the DOE contractor (Roy F. Weston, Inc.), which is responsible, under DOE direction and guidance, for preparing the annual total system life-cycle cost (TSLCC) estimates. We reviewed and compared the six annual TSLCC estimates to determine the major reasons why the estimates increased from less than $20 billion in 1983 to over $30 billion in 1989. We discussed changes in the estimates with DOE and contractor officials to determine the bases for the changes, evaluating particularly if and how the changes related to the nine criteria. We also compared the architectural engineer's initial repository cost estimates with OCRWM's final estimates.

We reviewed the work of DOE's Independent Cost Estimating (ICE) staff, which prepares annual TSLCC estimates and fee-adequacy assessments independent of those prepared by OCRWM. Among other things, we compared the estimates prepared by ICE and OCRWM to identify the reasons for any major differences to determine how such differences are resolved.

We also reviewed the work of DOE's Budget Validation Group. This group is responsible for, among other things, validating the accuracy of

OCRWM's annual budget estimates relating to capital expenditures to construct the exploratory shafts and related facilities to be built in conjunction with site characterization activities.

Projecting Interest Revenues and Fund Balances

Battelle Memorial Institute, a DOE contractor, makes the detailed reviews DOE uses in assessing fee adequacy. Battelle, among other things, uses EIA's electric generation and nuclear waste projections and the TSLCC estimates to determine whether the fee will produce sufficient revenues to cover program costs. This determination is made for a number of scenarios using different program assumptions about such matters as system configuration. As a part of its review, Battelle projects annual interest revenues and/or expenses and program fund balances through the program's end. Battelle's 1987 fee adequacy analysis was primarily based on a real interest rate of 3 percent; however, it also examined the effects of real interest rates of 0, 1, and 5 percent.

In performing this review segment, we reviewed and evaluated Battelle's annual reports, which it began issuing in 1984, and other Battelle studies and documents relating to DOE's assessments. We discussed Battelle's annual report, including study assumptions and methodology, with officials of Battelle and OCRWM. We reviewed Battelle's Fee Adequacy Model, including available model documentation and the major assumptions implicit in the model's input data. We also diagrammed the logic of all the model's programs. We did not, however, validate this model.

Assessing Fee Adequacy

We reviewed and evaluated DOE's annual fee-assessment reports for 1983-87. These reports set forth DOE's recommendations to the Congress as to the need for an adjustment to the fee, and the support and rationale for its recommendation. The 1987 assessment report was the latest reviewed because a report for 1988 was not issued and the 1989 report had not been issued at the time of our review. We did review the TSLCC analysis, which was publicly released in September 1989, and an ICE staff assessment report issued in February 1989.

We met with DOE officials to discuss the decision-making process DOE follows in judging whether the fee is adequate or needs to be adjusted. As part of this review, we issued a report to the Secretary of Energy in July

1988 that addresses DOE's treatment of inflation in its decision-making process.[8]

Defense Waste Fee Issues

In reviewing DOE's proposed approach to pay for disposal of defense wastes, we analyzed the effects that the approach would have on the Nuclear Waste Fund from the standpoints of balances in the Fund and fairness to civilian ratepayers. We also assessed the effects on DOE's defense waste budget and the cost to the government on a consolidated basis.

In addition, we reviewed available DOE and contractor documents setting forth policies, procedures, and guidance. We also (1) reviewed applicable GAO and DOE Inspector General (IG) reports and various studies such as an August 1984 special study by the Congressional Budget Office entitled Nuclear Waste Disposal: Achieving Adequate Financing and (2) contacted officials of the Edison Electric Institute, a trade organization, and the National Association of Regulatory Utility Commissioners.

Our review was made from January 1988 through September 1989 and covered DOE activities carried out from 1982 through 1989. Our audit work was performed in accordance with generally accepted government auditing standards.

Agency Comments and GAO Evaluation

We obtained written DOE comments on a draft of this report, which are contained in appendix II. DOE agreed with the facts presented in our report and with all but one of our recommendations. Nevertheless, we are concerned that DOE's planned corrective actions may not adequately insure against a future funding shortfall in the Nuclear Waste Fund that might have to be borne by taxpayers. For example, DOE agreed to study--not implement--our recommendation that it provide adequate contingencies in all major cost categories. We will be better able to judge the adequacy of DOE's actions after it issues its next fee-adequacy report and cost estimate, now scheduled for late spring of this year.

[8]Nuclear Waste: DOE Should Base Disposal Fee Assessment on Realistic Inflation Rate (GAO/RCED-88-129, July 22, 1988).

Reliability of Cost Estimates Improving, but Major Cost Uncertainties Remain

The estimated cost of the nuclear waste management program has increased by 60 percent since DOE issued its first cost estimate in 1983. At that time, DOE estimated that it would cost under $20 billion (1982 dollars) to dispose of civilian nuclear waste in two repositories. Its most recent estimate is about $32 billion (1988 dollars). DOE also estimates that the program will cost about $25 billion with only one repository.

Of the more than $12 billion increase in estimated costs, about $4.5 billion is due to inflation over the first 6 years of the program. The remaining increase of about $8 billion represents real growth in estimated costs. This cost growth occurred as DOE more clearly identified the program system, assumptions, and performance requirements. Had it not been for changes in basic requirements that generally reduced the scope of the program, such as eliminating characterization of three candidate repository sites, DOE's most recent cost estimate would be billions of dollars higher.

Considering the unique nature of the nuclear waste program, DOE's recent cost estimates are more reliable than estimates made early in the program's life. DOE's cost estimates are now more complete because they include the costs of certain activities that were not included in earlier estimates and are based on a better understanding of required tasks. Further, DOE is developing standardized cost accounts to help estimate and control costs, is obtaining broad participation by its contractors in developing cost-related information, and is using better and more up-to-date data. DOE also obtains an independent internal review of each annual cost estimate. Finally, although DOE does not address the effects of inflation on future program costs in preparing its cost estimates, it does address this factor in making its annual assessments of fee adequacy (see ch. 3).

Nevertheless, considering how cost estimates have increased over the last 6 years and the uncertainties that must be considered in estimating costs over nearly a 100-year period, it is reasonable and prudent to assume that the actual cost of the nuclear waste program will be much higher than currently estimated by DOE. Major uncertainties include inflation, schedule delays, and the number and location of repositories to be built. Despite such major uncertainties, DOE does not include a liberal, system-wide contingency allowance in its cost estimates.

Effects of Inflation on DOE's Cost Estimates

DOE expresses each of its cost estimates in terms of the purchasing power of the dollar for the most recent full year. For example, its first cost estimate, issued in 1983, expressed all costs in constant 1982 dollars regardless of the years in which various activities would be performed and their associated costs incurred. Each of DOE's annual cost estimates is shown in table 2.1.

Table 2.1: Comparison of Unadjusted Total System Life-Cycle Cost Estimates

Dollars in billions

	Year of fee-adequacy report[a]					
Major cost category[b]	**1983**	**1984**	**1985**	**1986**	**1987**	**1989[c]**
Development and evaluation	$4.7	$7.6	$7.8	$9 2- 9.5	$14.6–14.7	$13.1
Transportation	3.9	2 5- 3.9	3.3- 5.1	1.7- 2 3	2.0- 2.2	2 3
Repository	10.7–11 2	10.5–12.9	12.5–16.9	11.9–19.7	12.6–18.7	13.4
MRS	[d]	[d]	[d]	2.8- 2.9	2.7	2 3
Benefit payments	[e]	[e]	[e]	[e]	[e]	0.9
Total[f]	**$19.3–19.8**	**$20.9–24.4**	**$23.8–29.7**	**$26.2–34.0**	**$32.1–38.2**	**$32.0**

[a]A fee-adequacy report and a cost estimate for 1988 were not issued. Although a fee-adequacy report was not issued in 1989, a cost estimate was.

[b]The estimates shown are in prior-year dollars. For example, the 1989 estimates reflects the purchasing power of the 1988 dollar.

[c]The 1989 TSLCC analysis, for comparability purposes, used the one scenario with the no-new orders electric generation projection, two repositories, and an MRS capable of consolidating fuel rod assemblies.

[d]A TSLCC estimate that included an integral MRS system was not made until 1986.

[e]Benefit payments were authorized by the Amendments Act of 1987.

[f]The range in total costs may not equal the sum of minimum/maximum costs for each category because (1) the ranges for each category may not be based on the same case and (2) independent rounding of the costs for each category was made.

Source: Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program (May 1989, DOE/RW-0236).

To determine how inflation has affected DOE's cost estimates over the years, and then to show how estimated real costs have changed, it is necessary to eliminate the effects of inflation by putting each annual estimate on the same basis as DOE's 1989 cost estimate. Inflation adjusted figures are generally more meaningful for analysis and decision-making purposes because they put the estimates on an equal footing in terms of the dollar's purchasing power. Because the 1989 estimate is expressed in constant 1988 dollars, each earlier cost estimate was also converted to constant 1988 dollars using the gross national product (GNP) deflator. Table 2.2 shows the results of this exercise.

The annual average inflation rate, as measured by the GNP deflator, has been relatively low during the past 6 years (it ranged from 2.6 percent to 4.6 percent). It has, however, had a significant effect on the estimated cost of the program. For example, as shown in table 2.2, adjusting DOE's 1983 TSLCC estimates to 1988 dollars increases the estimates from $19.3-$19.8 billion to $23.7-$24.3 billion. This increases the 1983 estimate by about $4.5 billion, or about 23 percent. Thus, adjusted for inflation the total program cost estimate increased by $7.7-$8.3 billion from 1983 to 1989 whereas unadjusted for inflation the estimate increased by $12.2-$12.7 billion.

Table 2.2: Comparison of Total System Life-Cycle Cost Estimates Adjusted for Inflation

Dollars in billions

	Year of fee-adequacy report[a]					
Major cost category	**1983**	**1984**	**1985**	**1986**	**1987**	**1989[b]**
Development and evaluation	$5.8	$9.0	$8.9	$10.1–10.4	$16.1–15.8	$13.1
Transportation	4.8	3.0- 4.6	3.8- 5.8	1.9- 2.5	2 1- 2.4	2.3
Repository	13.1–13.7	12 4–15.2	14.2–19.2	13.1–21.7	13.5–20.1	13.4
MRS	[c]	[c]	[c]	3.1- 3.2	2.9	2.3
Benefit Payments	[d]	[d]	[d]	[d]	[d]	$0.9
Total[e]	**$23.7–24.3**	**$24.7–28.8**	**$27.1–33.8**	**$28.9–37.4**	**$34.5–41.0**	**$32.0**

Note: Estimates were converted to 1988 dollars using GNP deflator.

[a]A fee-adequacy report and a cost estimate for 1988 were not issued. Although a fee-adequacy report was not issued in 1989, a cost estimate was

[b]The 1989 TSLCC analysis, for comparability purposes, used the one scenario with the no-new orders electric generation projection, two repositories, and an MRS capable of consolidating fuel rod assemblies

[c]A TSLCC estimate that included an integral MRS system was not made until 1986.

[d]Benefit payments were authorized by the Amendments Act of 1987.

[e]The range in total costs may not equal the sum of minimum/maximum costs for each category because (1) the ranges for each category may not be based on the same case and (2) independent rounding of the costs for each category was made

Source: Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program (May 1989, DOE/RW-0236).

Changes Helped Hold Down Cost Estimate Increases

A number of basic program changes have taken place since DOE made its first comprehensive cost estimate in 1984. Some of these changes, particularly the elimination of costs to characterize three sites and the reduction in the projected quantity of waste to be disposed of, have helped hold down the increases in the program cost estimates.

DOE's 1983 cost estimate was primarily based on a DOE-contractor study completed in December 1982, shortly before NWPA was enacted.[1] The first comprehensive cost estimate DOE prepared on the basis of the act was issued in 1984. That estimate was based on

- characterization of three candidate sites for the first repository and two more candidate sites for the second repository;
- construction and operation of two repositories;
- shipment of 134,000 metric tons of uranium (MTU) of civilian waste directly from nuclear power plants to the two repositories for disposal; and
- an end to the program's life, for cost-estimating purposes, in 2040.

At the time of the 1984 estimate, DOE was considering four types of rock—domed salt, bedded salt, tuff, and basalt—for the first repository and granite as an additional rock-type for the second repository. Also, it had already identified nine potential sites from which to choose the three sites to be characterized for the first repository. On the basis of this program configuration, DOE's estimate of total program costs was between $24.7 billion and $28.8 billion (adjusted to constant 1988 dollars), as shown in table 2.2.

Since DOE prepared its 1984 cost estimate, several basic program changes have occurred. Specifically, for the 1989 cost estimate,

- DOE assumed that it will characterize only the Yucca Mountain site for the first repository and one other site if a second repository is eventually developed;
- the projected quantity of wastes to be disposed of, including DOE's defense waste, dropped to about 96,000 MTU;
- the life of the program was extended through 2089; and
- DOE included an MRS facility and benefit payments to host states or Indian tribes in its cost estimates.

Because of the Amendments Act provisions (1) limiting site characterization to Yucca Mountain, (2) deferring second-repository activities, and (3) authorizing an MRS facility, OCRWM reduced the number of scenarios for which it made cost estimates from 15 in 1984 to 5 in 1989. DOE's 1989 TSLCC analysis estimates the costs of a waste management system with one- and two-repository configurations. In either case, the first

[1] Projected Costs for Mined Geologic Repositories for Disposal of Commercial Nuclear Wastes (ONI-3, Dec. 1982).

repository is assumed to be located at Yucca Mountain. The second repository, if developed, would be located at a site that is central to most civilian nuclear power plants—in essence, in the eastern part of the country.

For both system configurations one estimate is made with an MRS facility that would consolidate the fuel into a more compact arrangement before shipping it to a repository and one with an MRS facility that would ship the fuel intact.[2] These scenarios assume that DOE would only be required to dispose of wastes produced by existing nuclear plants and DOE's defense wastes. A fifth scenario using EIA's more optimistic forecast of electric generation, which assumes that utilities will construct many new nuclear plants, is for a two-repository system and an MRS facility that would consolidate fuel before shipment. DOE's estimates of the cost of these alternative waste systems is shown in table 2.3.

Table 2.3: 1989 Total System Life-Cycle Cost Estimates[a]

Dollars in billions

	No-new orders scenario				Upper reference scenario
	Two repositories		One repository		Two repositories
Major cost category	MRS fuel consolidation	Basic MRS[b]	MRS fuel consolidation	Basic MRS[b]	MRS fuel consolidation
Development and evaluation	$13.1	$13.1	$9.7	$9.7	$13.1
Transportation	2.3	2.3	2.6	2.6	2.4
First repository	6.7	7.0	8.7	9.1	6.6
Second repository	6.8	6.6	0.0	0.0	7.4
MRS facility	2.3	1.4	3.1	1.8	2.3
Benefit payments	0.9	0.9	0.7	0.7	0.9
Total	**$32.0**	**$31.2**	**$24.8**	**$23.8**	**$32.7**

[a]Costs are in constant 1988 dollars.

[b]In this scenario, the spent fuel is disposed of without being consolidated.

Source: Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program (May 1989, DOE/RW-0236).

Development and evaluation cost estimates, adjusted for inflation, increased from $9.0 billion in 1984 to $13.1 billion in 1989, an increase of $4.1 billion. This increase would have been several billion dollars higher had it not been for the elimination of costs for characterizing three sites following enactment of the 1987 Amendments Act. In its May

[2]Fuel consolidation involves rearranging spent-fuel rod assemblies into a denser array, thereby reducing the number of containers requiring disposal.

1989 cost estimate, DOE stated that, in the absence of the amendments, estimated costs for development and evaluation would have risen to about $18.7 billion (1988 dollars), an increase of about $5.6 billion over the $13.1 billion estimate.

Also, DOE's 1989 cost estimate for a single-repository system is about $24.8 billion, or about $7.2 billion less than the cost estimate for two repositories (see table 2.3). The lower cost for a single-repository system results from the elimination of about $6.8 billion to construct the second repository, a decrease of about $3.4 billion in development and evaluation costs, and a decrease in benefit payments of about $0.2 billion. These decreases were partially offset by increases of about $2.1 billion to expand the first repository to hold all of the waste, about $0.7 billion for the MRS facility, and about $0.3 billion for transportation.

Another factor helping to hold down program cost estimates is the decrease in the projected quantity of waste. The current estimate of about 96,000 MTU (compared with 134,000 MTU in 1984) includes the 86,800 MTU of civilian waste that EIA expects existing civilian nuclear power plants to produce through the end of a 40-year operating life for each plant. The figure also includes the equivalent of 8,875 MTU of defense wastes that DOE projects it will produce through 2030 and 640 MTU of waste from a closed civilian spent fuel reprocessing plant, located at West Valley, New York, that DOE is decommissioning.

The reduction in projected waste quantity helps reduce the estimates of the transportation and repository cost categories. For example, DOE will need fewer transportation casks and will make fewer waste shipments. Also, less waste means lower repository-related costs such as waste handling, mining, and waste package fabrication. Therefore, as shown in table 2.2, after adjusting DOE's earlier cost estimates for inflation, estimated transportation and repository costs have generally decreased between 1984 and 1989. Not all of the repository cost reductions, however, are due to reduced waste quantities. For example, some of the reductions are related to eliminating potentially high-cost repository sites from consideration in the nuclear waste program.

Better Identification of Program Tasks

Adjusted for inflation, the estimated real cost of the nuclear waste program has increased by about $8 billion (1988 dollars). This increase is due in large part to cost items being added as the program became better defined. In addition to making the estimates more complete, and thus more reliable, DOE has made and is making other changes to improve the

estimates. For example, an across-the-board contingency factor of 20 percent is now included in the transportation cost category.

Clear identification of tasks is critical to preparing reliable and complete cost estimates. As discussed earlier, DOE's initial cost estimate was based on a study issued before NWPA was enacted. Because the estimate was based on conceptual designs that were not fully applicable to or consistent with the program established by the act, it cautioned that the cost estimate "should be considered as 'expected values' with a large uncertainty margin."

The 1984 cost estimate was the first comprehensive DOE estimate reflecting its strategy for carrying out the waste program mandated by NWPA.[3] Although comprehensive, the estimate was considered to be preliminary and subject to the usual sources of error in any preliminary engineering cost estimate as well as other factors peculiar to the program. These other factors included the lack of definition in both the development and evaluation and the repository cost categories. For example, the repository costs were based on designs that DOE considered to be "preconceptual," at best. On the basis of the above, the cost-estimate analysis stated that the cost estimate for the total system was even more uncertain than typical preliminary engineering estimates.

Development and Evaluation Costs

Development and evaluation cost estimates are based on DOE's annual budgets. Unlike the other major cost categories, budgets must be prepared for development and evaluation costs because it is the only category for which expenditures are currently made. DOE's 5-year budget estimate, added to the actual program expenses already incurred, and projected costs through the end of the program, make up the total development and evaluation cost estimate.

Development and evaluation costs are broken out into the seven major subcategories shown in table 2.4 and are further subdivided through use of a detailed work breakdown structure used in DOE's financial information system. While the methodology for each of the seven categories varies somewhat, the basic approach is to determine the work that must be done to complete the milestones set forth in the program schedule. The budget cost estimates are used as a basis for projecting future costs.

[3]Preliminary Analysis of the Total System Life Cycle Cost of the Commercial High-Level Radioactive Waste Disposal Program (April 27, 1984).

A somewhat different method is used to estimate the cost of government administration. This cost is estimated based on the proportion of actual government administration costs to all development and evaluation costs incurred; however, DOE establishes minimum annual cost estimates. In the 1989 estimates, these minimums were $25 million per year through the end of waste disposal operations in 2044 and $15 million per year through the remaining life of the program.

Table 2.4: Development and Evaluation Cost Estimate

Dollars in billions

Cost category	Amount
First repository	$5.2
Second repository	3.1
MRS facility	0.3
Transportation	1.0
Systems integration	0.2
NRC fees	0.7
Government administration	2.6
Total	**$13.1**

In January 1988 DOE issued a draft of its site characterization plan for the Yucca Mountain site (DOE issued the final plan in December 1988). The plan, which is a nine-volume document of over 6,000 pages, describes in detail all the activities to be done in determining if the Yucca Mountain site is suitable for a repository. The increased scope of work called for by the plan resulted in significant increases in site characterization costs.

Another factor that has increased the estimated development and evaluation costs is the extension of the expected life of the program by 49 years between the 1984 and 1989 cost estimates—primarily because of changing assumptions concerning waste retrievability requirements. The longer program life has significantly increased DOE's estimate of government administration costs.

Nuclear Regulatory Commission (NRC) regulations governing the construction and operation of DOE's high-level waste repositories require that repositories be designed so that the waste can be retrieved during a 50-year period to confirm (monitor) repository performance. In prior estimates, DOE had assumed that it would backfill repository shafts and tunnels with rock during this 50-year period; however, in the 1985 estimate, DOE assumed that backfilling would not begin until the end of the

period.[4] This change resulted in the need to incur costs to administer the program through 2068, an additional 28 years. The cost of this additional program activity was offset, however, by a reduction in the estimated minimum annual cost of government administration from $20 million to $10 million.

DOE's 1986 cost estimate extended the program's expected life another 21 years until 2089. This extension was due primarily to a change in assumptions relating to backfilling the second repository. In its 1985 cost estimate, DOE had assumed that the second repository would be backfilled in 8 years, but in its 1986 estimate DOE assumed that this activity would require 27 years. The original assumption was based on data related to the Yucca Mountain site, and the new assumption was based on data obtained from the basalt rock site at Hanford, Washington. This change was made to ensure a more conservative cost estimate for the second repository. DOE also increased the estimated minimum annual cost of government administration from $10 million to $15 million.

The extension of the program's expected life until 2089 and a $5 million increase in the estimated minimum annual administrative costs, resulted in the 1986 estimate of government administration costs increasing by about $800 million over the 1985 estimate.

Repository Costs

Through the years, repository system designs have become more defined. Initially, estimates for the several sites being considered were all based on system designs for two salt sites under consideration for a repository early in the program. The first time a site-specific design for the Yucca Mountain site was used for cost-estimating purposes was in 1985. Site-specific designs are an important ingredient in preparing accurate cost estimates because they allow the consideration of such factors as depth and size of the particular repository. DOE's 1989 estimate for first-repository costs is primarily based on a December 1988 report on costs, schedules, and operations at a repository located at Yucca Mountain. Additional design and cost data used in preparing the estimate were taken from the January 1988 draft site characterization plan and a December 1988 DOE-contractor study of a waste-management system with an MRS facility and a repository at Yucca Mountain.

[4]Although it is obviously easier to retrieve wastes before backfilling occurs, an OCRWM official said that the waste can be retrieved after a repository is backfilled.

First-repository cost estimates are initially developed by the applicable architectural and engineering firm in accordance with guidance provided by Roy Weston, Inc., the DOE support contractor responsible for the annual cost analyses. Because neither the location nor the type of rock for the second repository is known, its estimated cost is based on average mining and operating conditions using design information for the two first-repository candidate sites eliminated by the 1987 Amendments Act. Applicable headquarters and field office personnel also participate in the development and review of the repository cost estimates.

Although a work breakdown structure is not currently used to estimate repository costs, Weston has developed a cost account structure to standardize the development of repository cost estimates for both repositories. According to a Weston official, the cost account structure will evolve into a work breakdown structure sometime in the future. Weston's estimating guidance, which provides a definition of each cost account, breaks out the account structure into the following seven major categories: management and integration, site preparation, surface facilities, shafts/ramps-underground, subsurface excavations, underground service systems, and waste package fabrication. As applicable, estimates for individual items under each of the seven major categories were made for engineering, construction, waste emplacement and caretaker, operations, closure, and decommissioning.

While the cost-estimating methodology can vary, according to Weston's guidance, a typical methodology would independently estimate the costs of the construction and operation phases. The estimated costs of construction and operation would consider local labor rates and material and equipment costs, to which are added such items as sales taxes and contingency factors. The estimate for other phases (i.e., engineering, closure, and decommissioning) would be based on a percentage of the construction cost estimates minus the add-on items such as sales taxes and contingency factors. The portion of the estimate that is attributable to contingency is not disclosed in the cost-estimate analysis.

The 1989 cost-estimate analysis compared the 1987 estimate of $5.5 billion (constant 1986 dollars) for the first repository with the 1989 estimate of $6.7 billion. According to the analysis, most of the increase was due to increases in the unit costs of the waste packages and the number of containers needed ($800 million), changes in underground service systems and excavation ($300 million), and the addition of the license-

application design costs that were previously included in the development and evaluation cost category ($262 million).[5]

Transportation Costs

Transportation costs are broken out into (1) the costs of shipping and security, (2) the costs of purchasing and maintaining the casks in which the waste is packaged for shipping, and (3) other costs. Shipping and security costs are first developed on a per-unit basis, that is, the cost of a single shipment divided by the quantity of waste shipped. The unit costs are then applied to the quantity of waste shipped between various points and the resultant costs are totaled by year. The number of casks to be purchased is based on expected usage. The "other" category includes the cost of constructing, operating, and decommissioning a cask-servicing facility. DOE adds a contingency factor of 20 percent of all estimated transportation costs to help cover cost uncertainties.

Most Cost Items Now Included in Estimate

As discussed above, the scope of program tasks and activities is becoming better defined as DOE learns more about what needs to be done to carry out program objectives and how long these efforts are likely to take. In earlier years, however, there were a few program-related facilities and activities that DOE should have either included within its cost estimates or explained why the items were not included. DOE has included most of these items in its 1989 cost estimate but, according to its Independent Cost Estimating staff, not all of them. The ICE staff, which is within the Office of Administration and Human Resource Management, reviews each of DOE's waste program cost estimates. According to this staff, there are at least two items still not included in that cost estimate.

One activity that DOE did not include in its cost estimates until 1989 is reimbursement of NRC for its program-related costs. According to the 1989 cost estimate, this activity is expected to cost over $700 million for the two-repository system. The inclusion of NRC's costs within the scope of waste program activities has been an issue since the early days of the program. For example, as long ago as 1983 the Office of Management and Budget proposed that moneys be transferred from the Nuclear Waste Fund to NRC to cover the latter agency's program-related costs. This was not done at that time because of the need to resolve related

[5]According to the analysis, the number of waste containers increased because of a new calculating method used that considers the heat rate of each spent-fuel assembly rather than the average heat rate used in the past.

legal issues. Until DOE issued its 1989 cost estimate, it neither included estimated NRC costs nor disclosed the potential for eventually adding these costs into future program cost estimates.

An additional item related to NRC activities also included in the 1989 cost estimate for the first time is an electronic information management system called the Licensing Support System. Although the system is being designed by a DOE contractor, NRC will administer it. The system will cost an estimated $195 million over a 10-year period. As in the case of cost estimates for NRC waste program activities, earlier DOE cost estimates did not disclose the potential for adding this item to the program's estimated cost.

In its 1987 cost estimate, DOE added the cost of constructing a facility to provide routine maintenance of transportation casks and to allow annual recertification of the casks by NRC—$66 million in constant 1986 dollars. The operating costs of the facility, however, were assumed to be covered by the annual cask maintenance charge. DOE recast these charges in the 1989 cost estimate to include the cost of constructing, operating, and decommissioning the facility, and as a result, the total cask service and maintenance estimate increased from $310 million in 1987 (1986 dollars) to $1 billion in 1989 (1988 dollars).

An OCRWM official who works on transportation matters stated that OCRWM recognized the need for a facility to service and recertify casks prior to 1987 but no estimate of its associated costs was made until the 1987 estimate. According to the official, OCRWM had neither the time nor the resources to develop a cost estimate for the facility.

According to the ICE staff, the transportation portion of DOE's 1989 cost estimate is still incomplete because it does not include the cost, estimated at $157 million, of constructing, operating, and decommissioning a facility to service the transportation fleet. Further, the estimate does not include the cost to decommission the transportation casks, which the estimating staff said would amount to about $45 million. The omission of these costs was brought to OCRWM's attention in a February 1989 report prepared by the ICE staff.[6]

The ICE staff cited the above items as reasons why its estimates of transportation costs were about $200 million (constant 1988 dollars), or 8 to

[6]Independent Cost Estimate for the Total System Life Cycle Costs and Fee Adequacy of the Civilian Radioactive Waste Management Program (Feb. 1989).

9 percent, higher than preliminary estimates shown in an August 1988 draft of what became DOE's 1989 cost estimate. OCRWM officials told us that while the need to include these costs in future estimates is under consideration, in the past they had assumed that the disposal costs would be offset by the salvage value of the casks.

Independent Review of Cost Estimates

Each year, DOE's ICE staff independently reviews DOE's cost estimates for the nuclear waste program. For example, in February 1989 the ICE staff completed a review of OCRWM's August 1988 preliminary cost estimate. The ICE staff's review showed program costs ranging from $26.6 billion for a one-repository system to $36 billion for a two-repository system. The ICE staff prepared estimates for the same three scenarios OCRWM used in its preliminary cost analysis. In that analysis, OCRWM had estimated costs for a system with two repositories, with the first repository built at Yucca Mountain and the second at an unspecified location. The preliminary cost analysis also estimated the cost of a single repository constructed at Yucca Mountain. All three scenarios included an MRS facility that would be capable of consolidating spent-fuel rod assemblies.

The ICE staff's cost estimates were 9 percent to 12 percent higher than OCRWM's preliminary estimates (see table 2.5). OCRWM's preliminary estimates ranged from $400 million more to $1.1 billion less than its final estimates for three similar scenarios (1988 dollars).

Table 2.5: Comparison of ICE Staff's Estimates With OCRWM's Preliminary Estimates

Dollars in billions

	Cost estimates		Difference	
Scenario	ICE	OCRWM	Amount	Percent
Two repositories, no new orders	$35.3	$32.3	$3.0	9
One repository, no new orders	26.6	23.7	2.9	12
Two repositories, upper reference	36.0	33.1	2.9	9

Note: The ICE staff escalated OCRWM's preliminary estimates to 1988 dollars by applying a 3.9-percent inflation factor

Source: Independent Cost Estimate for the Total System Life Cycle Costs and Fee Adequacy of the Civilian Radioactive Waste Management Program (February 1989)

The ICE staff's estimate of repository costs was substantially above OCRWM's preliminary estimate made in August 1988—$15.5 billion compared with $13 billion for a two-repository system. The ICE staff said

that its estimate was higher principally because ICE (1) included a second waste handling building as set forth in the June 1988 draft amendment to DOE's mission plan, whereas OCRWM assumed one building,[7] (2) assumed tighter quality assurance in mining and waste packages, and (3) used higher stainless steel prices for the waste packages. An OCRWM official said that the next mission plan amendment will use a specific waste handling building. Also, DOE's 1989 cost estimate was based on updated stainless steel prices. Thus, two of the three reasons for the differences between the two estimates appear to have been resolved. An ICE official told us, however, that the potential for higher costs resulting from more stringent quality assurance requirements remains a major concern of the ICE staff.

Large Uncertainties in Program Costs Remain

Despite the improvements in DOE's cost estimates over the years, several major uncertainties in the program could have a material effect on actual program costs in future years. Two of the uncertainties are whether a second repository and an MRS facility will be developed. Another is the suitability of the Yucca Mountain site for the first repository. In addition, the long-term schedule for completing major program tasks is uncertain. And finally, the unique and long-term nature of the program make estimates of its eventual cost relatively uncertain both because of potential inflationary and real cost increases. In preparing its annual cost estimates, DOE has addressed the uncertainty over the number of repositories. There are other steps that it could take to address, disclose, and account for the other uncertainties.

Number of Repositories

The Amendments Act directs DOE to characterize only the Yucca Mountain site as a potential first repository. The act also requires DOE to report to the President and the Congress between January 1, 2007, and January 1, 2010, on the need for a second repository. The amendments do not, however, alter the requirement contained in the 1982 waste act that NRC, in authorizing DOE to construct and operate the first repository, prohibit emplacement of more than 70,000 metric tons of waste in the repository until a second one is operational. According to the legislative history of the NWPA, the temporary capacity limit was intended to ensure that two repositories, regionally dispersed, would be developed so that no state would have to bear the entire burden of waste disposal.

[7]In accordance with the provisions of Section 301 of NWPA, DOE issued its plans for implementing the waste management program in June 1985.

Even if the limit is lifted, a second repository might be needed if the Yucca Mountain site cannot accommodate a repository large enough to hold all the civilian and defense wastes expected to be produced—currently projected at 96,300 MTU.[8] DOE has addressed this uncertainty in its May 1989 cost estimate by estimating the cost of the program with both one and two repositories.

Monitored Retrievable Storage Facility

NWPA required DOE to study the need for and feasibility of an MRS facility capable of providing long-term storage, continuous monitoring, management, and maintenance of the wastes and ready retrievability for further processing or disposal. On March 31, 1987, DOE submitted a proposal to the Congress to build and operate an MRS facility in Oak Ridge, Tennessee.

The Amendments Act authorizes DOE to construct and operate an MRS facility but voids DOE's selection of Oak Ridge as the MRS site. Instead, a three-member MRS Review Commission was established to evaluate the need for an MRS facility as a part of a national nuclear waste management system that will achieve the purposes of the NWPA, as amended. As required, the Commission reported the results of its evaluation, including its recommendations, to the Congress on November 1, 1989.[9] The Commission concluded that an MRS facility cannot be justified under the act's conditions, which link the facility's capacity and schedule of operation to that of the permanent repository. The Commission recommended that the Congress authorize construction of an emergency storage facility limited to 2,000 MTU of waste and of a user-funded interim storage facility limited to 5,000 MTU of waste. The Commission also recommended that the Congress reconsider the subject of interim storage by the year 2000.

As required by the amendments, DOE must conduct a new site selection survey if it determines that an MRS facility is needed. DOE could not begin a new survey and evaluation of potential MRS facility sites, however, until the Commission submitted its report to the Congress. Further, DOE may not select an MRS facility site until after it recommends a repository site to the President and cannot begin construction of the MRS facility until NRC has issued a construction authorization for a repository.

[8]For a more detailed discussion of this matter, see our report entitled Nuclear Waste: Fourth Annual Report on DOE's Nuclear Waste Program (GAO/RCED-88-131, Sept. 28, 1988).

[9]Nuclear Waste: Is There a Need for Federal Interim Storage? (Nov. 1, 1989).

Of particular concern to the future of an MRS facility will be the success in selecting a site from a political standpoint. For example, in its report, the MRS Review Commission was not optimistic that either DOE or the Nuclear Waste Negotiator—a position within the Executive Office of the President empowered to negotiate potential agreements for nuclear waste facilities—would be successful in obtaining a state's agreement to host such a facility. DOE could address uncertainty over the MRS facility by including in its annual cost estimates an estimate of the cost of the waste program without such a facility.

Suitability of Yucca Mountain

If DOE eventually determines that the Yucca Mountain site is suitable for a repository, it must recommend its selection to the President. If the site is unsuitable, DOE is not authorized to select another candidate site. Instead, it must terminate all site-specific activities, report to the Congress and the state that the site is unsuitable, and, within 6 months, provide the Congress with recommendations for further action to ensure the safe, permanent disposal of nuclear waste.

Before DOE can determine the suitability of the site, it must investigate the geologic conditions at the site. As discussed below, DOE now expects this site characterization process to take until 2001. Although a determination that the site is unsuitable could be made at any time after site characterization begins, a decision that the site is a suitable one will not be made for at least 11 years. DOE could address this uncertainty by including in its annual cost estimates an estimate of the cost of stopping work at Yucca Mountain, selecting and characterizing another site, and developing the first repository at the other site.

Schedule

Another program uncertainty that is critical to DOE's cost estimate is the waste program's schedule. Some key milestone dates assumed in the 1989 analysis include

- submitting a license application to NRC in 1995,
- receiving NRC construction authorization and beginning repository construction in 1998,
- beginning waste receipt in first repository in 2003 and in second repository in 2032, and
- completing waste receipt in first repository in 2027 and in second repository in 2042.

Establishing realistic program milestones is difficult, particularly for the matters outside of DOE's direct control. For example, one reason for program delays is the difficulty DOE has had in obtaining Nevada's approval of applications for environmental permits needed to begin characterizing the site. Nevada recently returned DOE's applications unapproved and is suing DOE to block further work on Yucca Mountain. Moreover, there is a potential for delays in obtaining an NRC license. While DOE's current schedule calls for it to obtain NRC approval of its license application within a 3-year period, a nuclear industry coalition, with extensive experience in licensing nuclear power plants, estimates that the licensing process will require from 5 to 7 years.

DOE revised its program schedule in November 1989, in part due to the environmental permit issue. The new schedule shows significant slippage in program milestones from those used in the 1989 cost estimate. For example, the expected start of repository operations slipped from 2003 to 2010. However, DOE points out that, because a licensed repository is a first-of-a-kind undertaking, the later schedule dates should be viewed only as reasonable targets. DOE could address the cost uncertainties posed by potential schedule delays by including in its annual cost estimates the estimated cost of program delays at key points, such as completing site characterization, obtaining authorization to construct a repository, and beginning repository operations.

Cost Estimates

DOE's nuclear waste program is a large and unique century-long undertaking. Although the major work effort in the early years—site characterization—has become much more clearly defined and costly over time, there is still considerable uncertainty about the time and effort that will be required to complete this effort. Also, the actual costs of government administration over the life of the program are uncertain. Despite these uncertainties, however, there is no contingency provision in DOE's cost estimates to cover cost uncertainties in the development and evaluation category.

Repository cost estimates do contain allowances for contingencies. These allowances, however, are explicitly recognized only in the detailed cost accounts. The overall amount of the contingency allowance for the repository cost category is not disclosed in DOE's cost estimates. In contrast, DOE's estimate of transportation costs contains a contingency allowance of 20 percent of all estimated transportation costs.

Conclusions

Despite a number of factors working to hold down program costs, such as less waste to dispose of and fewer sites to characterize, the estimated cost of the program has increased from under $20 billion in 1983 to $32 billion in 1989. A major reason for this increase is related to the most important of the criteria we believe are basic to an effective cost-estimating process—a clear identification of the task. As the program became better defined and more complete, major cost items were added. Another major reason for the increase is inflation, which accounts for about $4.5 billion of the approximate $12 billion increase.

The 1989 estimate could be understated by over $2 billion. First, the 1989 TSLCC analysis does not include costs for a transportation fleet servicing facility and transportation cask decommissioning that DOE's ICE staff estimates would cost $200 million nor does it explain why such costs were excluded. Second, the TSLCC estimate does not include any provision to cover cost uncertainties for program development and evaluation. Applying the 20 percent allowance provided for the transportation cost category to the development and evaluation cost category would increase the 1989 estimate by about $2.6 billion for a two-repository system. Further, while provisions are made for cost uncertainties associated with the individual elements making up the estimated cost of the repository category, the cost-estimating analysis could be more informative if it disclosed the amount of the repository cost-category estimate allowed for contingencies.

Although correcting the above problems would further improve the reliability of the estimates, their accuracy would still be questionable because of the difficulty in successfully predicting events and costs for this long and unique program. Accordingly, we believe that the estimated cost of the program will continue to increase as DOE proceeds with its research and development effort, system design refinements, and complex licensing procedures. Program delays, which have already pushed back the scheduled repository operating date by 12 years, will continue to create cost uncertainties. Another uncertainty is whether Yucca Mountain will prove to be suitable for a repository. If not, significant additional costs would be incurred for such things as the search for a new site, environmental impact studies, and site characterization.

It could be useful to the Congress, DOE officials, and others interested in assessing the adequacy of the waste fee if estimates were made for scenarios covering major program uncertainties. For example, considering the potential for future program delays, it could be beneficial in judging

fee adequacy to know what effect further delays could have on estimated costs. Also, it could be important to know what the effect on program costs would be if Yucca Mountain is determined to be unsuitable for a nuclear waste repository.

The recognition of inflation is also basic to an effective cost-estimating process. Although DOE does not recognize inflation in developing its estimate, it does consider inflation in its fee-assessment analysis. Thus, our concerns about DOE's treatment of inflation are discussed in chapter 3.

Recommendations to the Secretary of Energy

To make the annual cost estimates of the nuclear waste management program more reliable and useful, we recommend that the Secretary of Energy (1) ensure that the estimates include the costs of all major facilities, tasks, and activities or, if excluded, explain the rationale for such exclusion, (2) have estimates made for additional scenarios, such as program delays and a finding that Yucca Mountain would not be suitable for a repository, and (3) ensure that all major categories of the estimates include adequate provision for contingencies and that the total portion of the estimates devoted to contingencies be disclosed.

Agency Comments and GAO Evaluation

DOE concurred with our first recommendation on including all cost elements in the estimates. DOE said that its estimates have included the costs of all system elements when such cost information was available, but that in the future it will also discuss the rationale for not including the cost of any known system components.

DOE did not concur with our second recommendation to make estimates for additional scenarios. DOE does not believe that analyses of further program delays and a potential finding of the unsuitability of Yucca Mountain for a repository should be used at this time to analyze the adequacy of the current fee. Nevertheless, DOE said that it performs analyses that are similar to those we recommend but that the results of these analyses are not published. It said that its analyses are performed for the purposes of "system optimization" and contingency planning. In regard to program delays, DOE noted its recent reevaluation of the program schedule and that, on the basis thereof, the planned target date for beginning repository operations was revised from 2003 to 2010.

The fact that DOE is already doing the types of analyses we are recommending shows that DOE believes that the information generated by the

analyses is useful. Regarding the question of whether or not the information should be published, we believe that the impact such events could have on program costs, and thus fees, would be of interest to the Congress and others having an interest in the fee, and therefore should be published. To help ensure that the results of its analyses, if published, are properly interpreted by the readers of its reports in assessing the adequacy of the waste fee, DOE could make sure that the analyses are accompanied by the proper explanations and caveats.

In regard to the program schedule, we would point out that, like earlier target extensions, the revised dates are only targets and that a whole host of things could happen to delay the program further. Accordingly, we believe that estimating what the program's costs will be if there are further delays could be useful.

Regarding our recommendations dealing with the provision for contingencies in its cost estimates, DOE said that it makes allowances for uncertainties in projecting development and evaluation costs, but that without cost estimating guidelines such as those used for estimating the costs of structures, the uncertainty is difficult to define explicitly. Nevertheless, DOE said that it will reevaluate the feasibility of developing an explicit contingency. Also, DOE said that in the future it will discuss, in the TSLCC report itself, the contingency provisions used in developing the program cost estimates.

Fee Adequacy Decision-Making Process Could Be Improved

A study by DOE's ICE staff shows that, if inflation averages 4 percent a year over the program's life and there is no fee increase, the Nuclear Waste Fund is underfunded by $2.4 billion for a one-repository system and $4.1 billion for a two-repository system (in discounted 1988 dollars). Although OCRWM's most recent fee-adequacy assessment produced similar results, it did not propose a fee increase because of the assessment method it uses. The method is directed at determining if, and when, DOE should begin automatically adjusting the current fee to account for inflation. Indexing the fee to the rate of inflation would help ensure that adequate revenues are collected to cover program cost increases due to inflation. It would also equitably distribute program costs among present and future payers of fees as the purchasing power of the dollar changes over time. However, NWPA, as amended, does not authorize such a system.

Also, OCRWM does not select an inflation rate estimate for use as its principal basis or most probable scenario for determining when indexing should begin. There is a critical need to do this in the assessment process considering that the cost estimates OCRWM prepares do not provide for cost increases due to inflation. OCRWM bases its analysis on several different program cost and revenue scenarios coupled with different inflation and interest rates. These scenarios, however, produced results showing both that indexing should have begun several years ago and that indexing is not needed. Since no scenario was designated as the most probable to occur, it is difficult to put the results of OCRWM's analyses of the various scenarios into perspective. Moreover, it is unclear how OCRWM made the decision that no fee increase was needed.

Further, DOE's fee assessments do not take into account the uncertainties in revenue collections from deferred utility payments of one-time fees for disposal of waste generated before April 7, 1983. If program cost estimates are understated and/or revenues are overstated, then either future payers of disposal fees will have to be charged much higher fees, the funding shortfall will have to be financed from general tax revenues, or a combination of both.

Finally, DOE has not made any payments covering the cost of defense-waste disposal. With interest accumulating on the unpaid balance, DOE's cost-share had climbed to $483 million by the end of September 1989. Its total share of costs is expected to be $3.6 billion to $6.4 billion, depending on whether one or two repositories are eventually developed. DOE is considering starting to pay its fair share in fiscal year 1991, including paying off the amount it already owes over the next 10 years. This

approach is sound. What is also needed in this deficit conscious environment is that DOE formally account for and disclose its cost share so that congressional and administration decision makers can assess the implications of making or deferring defense waste payments while considering competing demands for funds.

Treatment of Inflation Crucial to Fee Adequacy

The proper treatment of inflation is critical to arriving at sound conclusions about fee adequacy. Much of the analysis presented in OCRWM's most recent fee-adequacy report of June 1987, however, was based on a 0-percent inflation rate coupled with a 3-percent real interest rate.[1] These analyses indicated that factors affecting interest earned on such investments play a critical role in determining assessment results. For example, for the high-cost waste program scenarios, projections of total interest earnings fluctuated greatly, ranging from about $11 billion to $102 billion in the annual assessments that OCRWM made during the 1984-87 period. By comparison, OCRWM's projections of fee collections and program costs for the same period were relatively stable, ranging from about $30 billion to $35 billion and from $24 billion to $32 billion, respectively.

Moreover, while the projections of fee collections decreased by about 14 percent from 1984 to 1987 and program cost estimates increased by about 30 percent, projections of interest earnings increased by more than 450 percent. Interest earnings and end-of-program fund balances are substantially increased when inflation is not taken into consideration. With inflation considered, however, program expenditures can outstrip revenues early on, creating a need to borrow funds and incur interest expenses. For example, the ICE staff's analysis shows that for the one-repository system, with a 3-percent real interest rate (i.e., the difference between the nominal interest rate and the inflation rate) and no inflation, the estimated end-of-program fund balance is $29 billion; however, with a 3-percent real interest rate and a 4-percent inflation rate, the ending balance is a $44 billion deficit (in constant 1988 dollars). (See table 3.1.)

[1]See Nuclear Waste Fund Fee Adequacy: An Assessment (DOE/RW-0020, June 1987).

Table 3.1: Projected End-Of-Program Fund Balances With Waste Fee of 1 Mill Per KWH

Dollars in billions (deficits shown in parentheses)

		Balance for each scenario		
Inflation rate	Interest rate	Two repositories, no new orders	One repository, no new orders	Two repositories, upper reference
0	0	$(9)	$(2)	$(3)
0	3	(4)	29	52
1	4	(28)	6	15
2	5	(47)	(14)	(14)
3	6	(64)	(30)	(38)
4	7	(77)	(44)	(57)

Note: Amounts shown are in constant 1988 dollars. The ICE staff derived these amounts by deflating the projections contained in its report to account for inflation but not for the time value of money. This approach is consistent with OCRWM's methodology. If the time value of money was accounted for, ICE's projections of the amount by which the program would be underfunded for the 4 percent inflation and 7 percent interest rate scenario would range from $2.4 billion to $4.1 billion.

Source: ICE staff adjustments to amounts shown in Independent Cost Estimates for the Total System Life Cycle Costs and Fee Adequacy of the Civilian Radioactive Waste Management Program (Feb. 1989) reflecting 1988 dollars.

Current Fee Will Not Recover All Program Costs With Inflation

In its February 1989 report, the ICE staff concluded that the 1-mill fee will not cover program costs unless there is little or no inflation over the life of the nuclear waste program. The ICE staff estimated that if the inflation rate averages 4 percent and the interest rate 7 percent, retaining the 1-mill fee would result in end-of-program fund deficits ranging from $44 billion to $77 billion (in constant 1988 dollars). The 4-percent inflation rate was the highest tested by ICE; however, as discussed later, it is below both the historic and projected rates for 25-year periods. Without an inflation indexing system, the ICE staff projected, the 1-mill fee may have to be increased immediately by up to 50 percent to recover long-term program costs.

In assessing the adequacy of the 1-mill fee, the ICE staff compared, using varying rates of inflation and interest, the "stream" of projected annual expenditures and revenues and calculated the interest earned or incurred each year on the fund balance or deficit. Based on its analysis, the ICE staff concluded that the 1-mill fee would not cover estimated program costs except in those cases where it is assumed that inflation averages less than 2 percent—an event the staff said is not likely to occur. (See table 3.2.)

Table 3.2: Fee Needed to Recover Program Costs

Fee in mills

Inflation rate	Interest rate	Balance for each scenario: Two repositories, no new orders	One repository, no new orders	Two repositories, upper reference
0	0	1.50	1.13	1.11
0	3	1.02	0.88	0.82
1	4	1.14	0.98	0.94
2	5	1.26	1.08	1.08
3	6	1.38	1.18	1.20
4	7	1.50	1.29	1.33

Source: Independent Cost Estimates for the Total System Life Cycle Costs and Fee Adequacy of the Civilian Radioactive Waste Management Program (Feb. 1989).

Although the ICE staff said that its analysis showed a need to adjust the fee to ensure full cost-recovery in accordance with the provisions of NWPA, the staff also said that it learned after completing its analysis that OCRWM's assessment of fee adequacy is based on determining when OCRWM should begin indexing the fee to inflation. Accordingly, the ICE staff said that in the future its analysis will be directed at determining when indexing should begin.

OCRWM's most recent assessment of June 1987 had produced results that are similar to the February 1989 ICE report. Projections of end-of-program fund balances by OCRWM showed that with 4-percent inflation and 7-percent interest rates, the current fee would result in deficits ranging from $21 billion to $76 billion (in constant 1986 dollars) for the then-authorized waste management system.[2] Despite this finding, however, OCRWM recommended that the 1-mill fee not be changed. The decision not to recommend a fee increase was based on OCRWM's assessment that it would not be necessary to immediately implement a system it plans to use to automatically revise the fee based on an inflation index.

OCRWM officials told us that they arrived at their decision after analyzing an "envelope of cases" of different scenarios—numbers of nuclear plants, quantities of waste, and waste-system configuration—and different interest and inflation rates. For example, OCRWM officials said that for the 1987 assessment they analyzed inflation rates of 2, 3, and 4 percent coupled with real interest rates of 1 and 3 percent to determine when it would be necessary to begin indexing the fee to inflation (see

[2]Although these figures account for inflation, they do not account for the time value of money. If the time value of money was accounted for, as measured by a real interest rate of 3 percent, OCRWM's 1987 underfunding estimates would range from $1.1 billion to $4 billion in 1986 dollars.

table 3.3). According to these officials, OCRWM did not use a base (probable) case in arriving at a decision about whether it will be necessary to implement an indexing system during the assessment year.

Table 3.3: Analysis Used to Determine When to Begin Indexing 1-Mill Waste Disposal Fee to Inflation

Scenario	Cost category	Year to begin with various inflation rates 2 percent	3 percent	4 percent
3 percent real interest rate cases				
Upper reference case				
Authorized system	Low	[a]	[a]	2004
	High	2003	1996	1993
Improved performance system	Low	[a]	2003	1998
	High	1995	1992	1990
No new orders case				
Authorized system	Low	[a]	2003	1997
	High	1989	1988	1988
Improved performance system	Low	1999	1994	1992
	High	[b]	[b]	[b]
1 percent real interest rate cases				
Upper reference case				
Authorized system	Low	2007	1998	1995
	High	1990	1989	1988
Improved performance system	Low	1999	1994	1992
	High	[b]	[b]	[b]
No new orders case				
Authorized system	Low	1992	1990	1989
	High	[b]	[b]	[b]
Improved performance system	Low	[b]	[b]	[b]
	High	[b]	[b]	[b]

[a]Inflation indexing not needed

[b]The 1-mill fee will not recover costs, even with no inflation; thus, a fee increase and an inflation indexing system are needed immediately.

Source: Nuclear Waste Fund Fee Adequacy: An Assessment (DOE/RW-0020, June 1987).

We discussed this OCRWM treatment of inflation assessment in a July 1988 report.[3] We said that the highest inflation rate OCRWM used in its June 1987 analysis—4 percent—is below both the actual average for

[3]GAO/RCED-88-129.

the past 25 years (5.3 percent) and the rate forecasted for the next 25 years by two major economic forecasting firms.[4] We recommended that OCRWM use a realistic, base-case inflation rate estimate in determining the fee required to recover program costs. We added that the sensitivity of OCRWM's projections could be tested by using inflation rates both above and below the base case. Also, we said that, although OCRWM could index the fee to inflation, the fee could not be changed automatically each year because NWPA precludes a fee change without a 90-day congressional review process. We expressed our opinion that the Congress would have to amend NWPA before OCRWM could implement an indexing system.

OCRWM officials told us that the next assessment report, currently scheduled to be issued in late spring of 1990, will correct many of the concerns we raised on their 1987 report. They told us that the upcoming report will do a better job of describing the process and methodology OCRWM uses to assess fee adequacy and the bases for its decision about whether or not to propose changing the current fee. Also, they said a wider range of inflation rates would be used in the assessment; however, they are not using a base-case inflation rate estimate in their assessment as we had recommended.

DOE addressed its reasons for opposing the use of a base-case inflation rate in an October 5, 1988, letter written pursuant to 31 U.S.C. 720.[5] DOE said that it believes that the use of a single base case is inappropriate because of the significant uncertainties affecting this long-term program. Specifically, DOE cited uncertainties about such factors as system configuration, nuclear electric generation, interest rates, and inflation rates. DOE said that the use of an envelope of cases in assessing fee adequacy is more appropriate than a single base case because alternative assumptions about these factors can have offsetting effects on fee adequacy. Lastly, DOE said that before it recommends an indexing system, it will consider our views on the need to amend NWPA.

DOE's arguments are not persuasive. Inflation, like the other factors DOE cited, must be recognized and realistically provided for in determining what the disposal fee should be set at to produce the revenues needed to

[4]We reported that Wharton Econometrics estimated that the annual inflation rate would average between 4.3 and 5.1 percent for the 25-year period from 1986 to 2011, and Data Resources, Inc., estimated that the rate would average between 4.1 and 6.8 percent for the 25-year period from 1987 to 2012.

[5]This law (31 U.S.C. 720) requires the heads of a federal agency to submit a written statement on actions taken on our recommendations to selected congressional committees.

cover program costs. We recognize that it is appropriate for OCRWM to test the sensitivity of cost, revenue, and fee-adequacy analyses to alternative assumptions. Making a convincing analysis of what costs and revenues are most likely to be, however, ultimately requires selecting values for key factors that OCRWM can defend as the most likely to occur. OCRWM does not recognize the factor of inflation in preparing its program cost estimates. If it did, however, one would presume that it would select an inflation rate that it could defend on the basis of either historical rates of inflation or projections by recognized economic forecasting firms. Such an approach would produce virtually the same result as using a realistic, base-case estimate of the inflation rate in its fee-adequacy analysis as we recommended in our July 1988 report. Thus, we continue to believe that our recommendation is valid.

Fee Adjustment Mechanism Important to Ensure Equitable Cost Recovery

Section 302(a) of the NWPA requires that DOE propose a fee adjustment to the Congress if, based on its annual review, DOE determines that the fee is either too high or too low. Thus, it is clear that in enacting NWPA the Congress was not only concerned with ensuring that all program costs be recovered from the generators and owners of the waste but that those who pay disposal fees not be overcharged.

In an August 1984 study of the waste disposal fee, the Congressional Budget Office (CBO) said that an "optimal fee" is one that collects neither too much nor too little money from ratepayers.[6] It said that in establishing such a fee there are two components: (1) assigning the correct fee based on current estimates of program costs and waste generation and (2) providing a mechanism for adjusting the fee. One fee adjusting mechanism CBO discussed is an inflation indexing system that would adjust the fee automatically to account for the effects of inflation on program costs and revenues.

We agree with CBO that to ensure full cost recovery the fee must be adjusted to recognize both real changes in the annual estimates of costs and revenues and changes due to inflation. As discussed in chapter 2, estimating the real cost of this unique, long-term program at this early stage is fraught with uncertainty. However, uncertainty over the long-term effects of inflation could be addressed by implementing an inflation indexing system that would provide for automatic fee adjustments each year. OCRWM officials told us that they favor such a system because

[6]Nuclear Waste Disposal: Achieving Adequate Financing, Congressional Budget Office (Aug. 1984).

it would help to ensure adequate revenues and to distribute costs equitably among present and future ratepayers by recognizing changes in the purchasing power of the dollar. It should be noted, however, that the current 1-mill fee constitutes only a small portion—1.34 percent—of the national average residential electricity price for 1988. Even with the maximum 1.5-mill fee that the ICE staff's analysis showed could be needed, the fee would still be only 2 percent of the national average price.

In our July 1988 report, we discussed the concern of utilities and others that the $2 billion surplus that the Nuclear Waste Fund had at the time indicated that the 1-mill fee was too high. We said that large surpluses in the Fund are to be expected in the early years of the program, when expenditures are relatively small, as contrasted with later years, during construction and operation of the repository or repositories. Early Fund surpluses should not influence decisions about fee adequacy because, as explained below, utilities operating nuclear plants during the first 50 or more years of the program's life must pay fees that will produce sufficient revenues to cover expenditures over the entire 100-year life of the program.

The 1989 cost-estimate analysis shows that expenditures will decrease substantially after the repository construction and operation phases have been completed. The completion date assumed in that analysis was 2042 for a two-repository system. The cost-estimate analysis shows annual expenditures peaking at $748 million in 2020, declining to $215 million in 2042 and dropping further to $74 million in 2043. From 2044 until the program's end in 2087, annual costs average about $66 million a year. Although expenditures would be made through 2087 under that program schedule, collection of annual fees would occur only through 2037, when the last of the current generation of nuclear plants is retired.[7] Therefore, DOE must ensure that the fees collected through 2037 produce sufficient revenues to pay all costs through that year plus all expenditures for the remaining 50 years of the program.

[7]Under EIA's no-new orders forecast, it is assumed that no new nuclear plants will be built beyond those currently operating and under construction. Thus, once the last of these plants ceases operations, no additional waste fees will be collected.

Uncertainty About Real Costs and Collection of One-Time Fees

In addition to the uncertainty in the waste program's cost and the adequacy of the current fee due to the long-term effects of inflation, as discussed in chapter 2, there is still significant uncertainty about what the real cost of the program will be. As previously discussed, the real cost of the program is likely to be higher than DOE currently estimates. The correct way to address this probability for the purpose of fee adequacy is, as we recommended in chapter 2, to make appropriate allowances in developing waste program cost estimates. There is also some uncertainty about whether utilities will be able to pay all of the one-time fees owed to the Nuclear Waste Fund for the nuclear waste that they generated prior to April 7, 1983.

The OCRWM and the ICE staff's fee adequacy assessments discussed earlier both assumed that DOE will collect all projected fees in a timely manner. However, DOE's Inspector General reported in 1986 and again in 1990 that collection of some of the one-time fees is doubtful.[8] According to the IG's latest report, OCRWM's collection of about $2 billion of the $3 billion in one-time fees and interest payments due by January 1998 is at risk. This is because of the uncertain financial position of 11 of the 17 utilities that chose to defer the payments until that time.[9] In commenting on the report, the Secretary of Energy stated that he had directed OCRWM to resolve this issue through one of the mechanisms that the IG recommended. The amount of the underfunding estimates shown in the OCRWM and ICE staff fee-adequacy analyses could be even greater if DOE does not fully collect the deferred payments of the one-time fees owed by utilities.

Uncertainty About DOE Payments for Disposal of Defense Waste

NWPA requires DOE to pay its fair share of waste program costs into the Nuclear Waste Fund but does not specify when payments should be made. To date, DOE—specifically its Office of the Assistant Secretary for Defense Programs—has not paid into the Fund. Regular payment of DOE's share of program costs depends on the willingness of the administration and the Congress to provide the necessary funds at a time when there are competing demands for funds to clean up and modernize DOE's defense complex.

[8]Accuracy of Fees Paid by the Civilian Power Industry to the Nuclear Waste Fund (DOE/IG-0231, Oct. 27, 1986) and Followup Review of Fees Paid by the Civilian Power Industry to the Nuclear Waste Fund (DOE/IG-0280, Mar. 26, 1990).

[9]In accordance with their waste disposal contracts with DOE, utilities could pay the one-time fee (1) in quarterly payments, with interest, (2) in a future lump-sum payment, with interest, or (3) in full by June 30, 1985, with no interest.

DOE stated in its August 1989 5-year plan for environmental restoration and waste management that it may begin paying its annual fair share into the Fund in fiscal year 1991 and also pay off its cost share from earlier years, plus interest, over a 10-year period. DOE's congressional budget request for fiscal year 1991, however, did not request such funds, apparently because their inclusion was not approved by the Office of Management and Budget. Nevertheless, we evaluated DOE's proposed payment approach from the standpoints of (1) fairness, or equity, to utilities paying fees for disposal of civilian nuclear wastes, (2) the cost to the federal government on a consolidated basis, (3) the effect on DOE's appropriation for atomic energy defense programs, and (4) the effect on the Nuclear Waste Fund. We found that the approach is fair, does not affect the government's overall waste-disposal cost, and does not severely affect the availability of funds from the Nuclear Waste Fund. The major impact over the next 10 years would be that funds paid into the Nuclear Waste Fund would not be available for use in cleaning up or modernizing DOE's defense complex. However, if DOE does not begin paying its share of waste program costs, the unpaid balance—and interest on that balance—will rapidly increase.

To assist congressional decision makers in establishing budget priorities, DOE needs to allocate waste program costs between utilities and DOE each year as well as fully disclose DOE's estimated total share of costs and the amount, including interest, that it already owes. These actions require accounting and reporting procedures for allocating costs between civilian- and defense-waste generators to provide for proper allocation and recording of program costs.

NWPA Provides Discretion on Payments of Defense Waste Fees

NWPA requires DOE to allocate waste program costs between civilian- and defense-waste generators. It also prohibits any federal department from disposing of nuclear waste generated or owned by the government into civilian repositories unless the department transfers to DOE, for deposit into the Nuclear Waste Fund, amounts "equivalent to" civilian waste disposal fees. Following the President's decision on defense waste disposal, section 8(b)(2) of NWPA required the Secretary of Energy to proceed promptly with arrangements, including cost allocation, for use of one or more of the civilian repositories for disposal of defense waste. In August 1987, DOE established a method for allocating the costs of the waste program between its civilian and DOE components. In an earlier report, we concluded that DOE's method complies with all NWPA requirements and is

consistent with the accepted accounting concept of allocating costs to parties that either caused them to be incurred or benefitted from them.[10]

Beyond the requirement for allocating costs and paying equivalent fees, the NWPA and its legislative history are silent on when the government should begin paying for disposal of defense waste. DOE has, however, outlined three basic policy positions that will affect whatever future payment procedure DOE adopts. First, DOE intends to allocate program costs between commercial and defense waste owners and generators beginning with the effective date of NWPA (Jan. 7, 1983), rather than the date of the President's decision to commingle the waste (Apr. 30, 1985).

Second, DOE intends that the time value of money will be included in calculating budget requests for defense waste payments beyond the time when OCRWM incurs related costs for disposal of defense wastes. In this regard, DOE has recognized that OCRWM has already made substantial outlays for development and evaluation activities for which its defense program has a proportional obligation.

Third, DOE intends to consider the adequacy of the civilian-and defense-waste fees independently so that the delay in defense waste disposal payments will not affect the civilian fees. In this regard, DOE intends to apply interest earned on investments of temporarily excess revenue from civilian fee collections to the allocated cost of disposing of civilian waste.

Equity to Utilities Not Affected

Through December 31, 1989, utilities had paid about $4.2 billion into the Nuclear Waste Fund. Upon payment of fees in accordance with their contracts with DOE, utilities are absolved from any further financial obligation for disposal of the related wastes. The fees become federal funds to be used, subject to congressional appropriation and direction, for waste disposal activities. In return for payment of fees, the government's responsibilities are to develop, construct, operate, and decommission a repository and any other waste facilities needed to implement the program, and to take title to and possession of the waste on which the utilities have paid disposal fees. NWPA required that DOE's waste disposal contracts with utilities stipulate that, beginning not later than January 31, 1998, DOE will dispose of the waste. All contracts include such a provision.

[10]Nuclear Waste: DOE's Method for Assigning Defense Waste Disposal Costs Complies With NWPA (GAO/RCED-89-2, Feb. 2, 1989).

In contrast to utilities, DOE's defense programs office has not made any fee payments into the Nuclear Waste Fund. Although DOE has not, as discussed in more detail later, formally allocated waste program costs to its defense programs, OCRWM estimates that the defense-waste share of costs through September 30, 1989, amounted to $483 million. This includes interest on the deferred payment of its estimated annual share of costs.

In its fee-adequacy assessments, OCRWM accounts for the effects of defense-waste disposal costs and fees on the adequacy of civilian-waste fees by assuming that each year its defense programs office pays into the Nuclear Waste Fund an amount equal to the estimated annual defense-waste disposal cost for that year. OCRWM's annual fee-adequacy determination, therefore, is designed to ensure full recovery of all civilian-waste disposal costs over the life of the waste program.

Because DOE has not paid its cost share into the Nuclear Waste Fund, revenues in the Fund derived from fees paid by utilities and interest earned on funds invested have been used to pay DOE's share of program costs. As a result, these revenues were not available for investment and, therefore, were not earning interest for use in offsetting future civilian-waste disposal costs.

However, with proper allocation of program costs between commercial and defense-waste generators, including credit for interest earned on investment of excess funds and interest charges on deferred payment of allocated costs, DOE's proposed payment option would not be inequitable. In this regard, the key to equitable treatment is for DOE to ensure that it maintains the civilian fee at a level that is only high enough to recover program costs related to disposal of civilian wastes.

Cost to the Government Not Affected

The cost of defense-waste disposal on a consolidated government basis is not affected by the absence of DOE payments to date into the Nuclear Waste Fund. Had DOE been making payments into the Fund, the government would have been borrowing funds by selling marketable obligations of the United States. As discussed above, however, deferring payments to later years results in interest charges to Defense Programs. The interest rates associated with the obligations are essentially the same rates that are used to compute interest earned by the Nuclear Waste Fund on investments in government obligations—and to be

charged to DOE's defense programs office on deferred payments. Specifically, NWPA states that interest rates on Nuclear Waste Fund investments are to bear interest at rates

> . . . determined to be appropriate by the Secretary of the Treasury, taking into consideration the current average market yield on outstanding marketable obligations of the United States with remaining periods to maturity comparable to the maturities of such investments, except that the interest rate on such investments shall not exceed the average interest rate applicable to existing borrowings.

No Major Effect on Nuclear Waste Fund

As of December 31, 1989, DOE had spent about $2.7 billion on the nuclear waste program, and the Nuclear Waste Fund had about $2.3 billion in amounts in excess of current needs invested in U.S. Treasury securities. Further, payments of civilian-waste fees into the Fund are expected to exceed program costs for many years. For this reason, DOE's proposed option of paying its waste program costs from prior years over the next 10 years should not materially affect the availability of money in the Nuclear Waste Fund.

Effect on Budget for Defense Programs

Funds for defense-waste disposal will be paid from DOE's "atomic energy defense activities" appropriation. Table 3.4 summarizes DOE's budget for this appropriation for the current and 2 most recent fiscal years. DOE's budget requests through fiscal year 1990 have not included funds for disposal of defense waste in a repository developed under NWPA.

Table 3.4: Atomic Energy Defense Activities Budget for Fiscal Years 1988 Through 1990

Dollars in millions

	Fiscal year		
Activities	**1988[a]**	**1989[a]**	**1990[b]**
Weapons activities	$4,170	$4,234	$4,479
Nuclear materials production	1,799	1,926	2,169
Defense waste and environmental restoration	885	975	1,145
Verification and control technology	158	155	150
Nuclear safeguards and security	78	80	87
Security investigations	32	40	41
New production reactors	20	60	304
Naval reactors development	607	630	652
Total[c]	**$7,749**	**$8,100**	**$9,027**

[a]Appropriation

[b]Budget request.

Source: DOE budget request for fiscal year 1990.

As shown in the table, DOE's budget request for defense waste and environmental restoration exceeded $1 billion in fiscal year 1990, or about 13 percent of the total defense activities budget. According to OCRWM's May 1989 waste program cost estimate, DOE's annual share of program costs is, with the exception of a few years, expected to be between $50 million and $100 million through 2011 (in constant 1988 dollars). The actual amounts in year-of-expenditure dollars will vary. Also, through fiscal year 2000, DOE would be paying about $50 million each year to pay off its share of waste program costs through fiscal year 1990. Thus, defense-waste fee payments as proposed by DOE would amount to between $100 million to $150 million per year. The annual fee payment would require adding to DOE's defense appropriation, reducing other defense activities, or some combination of both of these actions.

Paying the defense-waste fees DOE is considering may be a formidable task in view of the competition for atomic energy defense funds. Specifically, DOE is in the early stages of a long-term program to address major safety and environmental problem areas in its aging nuclear defense complex. On the basis of our analysis of available cost data in 1988, the defense complex cleanup and modernization program will cost from about $100 billion to over $130 billion.[11]

On the other hand, waiting until some future year to begin making fee payments would result in much higher fees at that time due to the accumulation of costs from prior years and interest charges on the unpaid balance. For example, using DOE's lowest cost case (one repository, with intact storage of wastes, and no new utility orders of nuclear plants), we calculated the cumulative defense-waste cost through 2000 assuming that DOE did not make any fee payments until after that year. Because DOE's cost estimate is expressed in constant 1988 dollars, we escalated the annual costs to year-of-expenditure dollars using a nominal interest rate of 7 percent. By the end of the period studied, the cumulative estimated defense-waste share of total program costs is about $2.3 billion, including $1.1 billion in interest charges.

Importance of Accounting and Disclosure

In making its periodic estimates of the total cost of the civilian nuclear waste program, OCRWM separates out estimated civilian- and defense-waste costs. In addition, in its June 1987 fee-adequacy assessment, OCRWM evaluated the adequacy of civilian fees by assuming that defense-

[11] Nuclear Health and Safety: Dealing With Problems in the Nuclear Defense Complex Expected to Cost Over $100 Billion (GAO/RCED-88-197BR, July 6, 1988).

waste fees were paid as related costs were incurred. The latter step permitted OCRWM to assume that all civilian fees paid into the Nuclear Waste Fund were either used to pay civilian-waste program expenses or were invested to produce income for such use in the future. As yet, however, OCRWM has not recognized the amount of defense-waste costs already incurred—determined in accordance with its August 1987 cost allocation method—in its Nuclear Waste Fund financial statements.

In its financial statements for fiscal years 1986 and 1985, OCRWM did include a note to the statements recognizing that DOE must pay fees for disposal of defense wastes that are equivalent to civilian disposal fees. It also stated that an agreement specifying the amount of such fees had not been completed. A similar note to DOE's financial statements for fiscal years 1988 and 1987 stated that in August 1987 DOE had published a "proposed" method for allocating costs between generators of commercial and defense wastes but that an agreement specifying payment schedules had not been completed.[12] This note did not, however, identify the estimated defense-waste share of costs as of the end of fiscal year 1988 even though (1) a share of waste program costs incurred since January 1983 are allocatable to DOE, (2) DOE is legally obligated to pay its share of program costs before disposing of its wastes, and (3) the cost allocation method had been in effect for a year.

DOE has also not discussed in its budget submissions the requirement that it pay defense-waste fees into the Nuclear Waste Fund. Thus, DOE's current share of nuclear waste program costs as determined by using its cost allocation method, as well as the government's obligation to pay these costs go unrecognized except in OCRWM's periodic estimates of the total cost of the nuclear waste program.

To ensure equitable treatment of civilian- and defense-waste generators, it is essential that OCRWM allocate costs to each class according to its cost allocation method. Moreover, budgetary disclosure of DOE's cost share is needed by the Congress to determine appropriate levels of revenues and expenditures and to establish national budget priorities. Future budgetary control is weakened by the absence of full budgetary disclosure because deferred nuclear waste disposal costs will affect future budget resource allocation.

[12]Although DOE referred to the cost allocation method as a proposed method, the method that it published in August 1987 was DOE's selected method. In December 1986 DOE had published a preferred and two alternative cost allocation methods for public comment.

Conclusions

Analyses made by the ICE staff and OCRWM show that the 1-mill fee will not produce sufficient revenues to cover program costs when it is assumed that inflation will average 4 percent over the life of the program. ICE's assessment, which considers the effects of the 1987 Amendments Act, shows that without a fee increase the Nuclear Waste Fund is underfunded by $2.4 billion to $4.1 billion, depending on whether DOE eventually develops one or two repositories. This assessment, however, assumes that DOE will collect all deferred payments of the one-time fees and related interest, which DOE's IG said is in doubt. It also assumes that DOE will pay its fair share of program costs.

Although DOE has not assessed the adequacy of the waste fee in over 2-1/2 years, its last assessment showed that the 1-mill fee could result in end-of-program deficits of billions of dollars. DOE's basis for not proposing a fee increase was not clearly stated in the report. OCRWM officials said that it was arrived at based on their analysis of a number of scenarios to determine when, and if, an inflation indexing system should be implemented. The scenarios in the report produced such a wide range of results, however, the way in which DOE arrived at its decision is still not clear.

An inflation indexing system could help ensure that sufficient revenues are collected to cover increases in cost estimates that are caused by price inflation. We agree with DOE's position that an inflation indexing system has the advantage of helping to ensure that the cost burden of the program, in real terms, is shared fairly among current and future users of nuclear-generated electricity. As we pointed out in our July 1988 report, however, an amendment to NWPA would be needed to implement a system that would automatically adjust the waste fee based on an inflation index. If the Congress provides such authority to DOE, the agency needs to give increased emphasis to anticipated inflation in determining when the indexing system should be implemented by using a realistic base-case inflation-rate estimate.

DOE believes that relying on a single base case is inappropriate because of the significant uncertainties affecting this long-term program. However, the greatest uncertainty involving inflation centers around the rate at which it will occur and not whether it will occur. Uncertainty about the rate of inflation can be dealt with through annual adjustments to projected inflation rates as conditions warrant.

Also, the use of a base-case inflation rate does not mean that the assessment should be limited to a single scenario. Obviously, there must be a

number of different scenarios analyzed based on differing assumptions about such matters as system design and configuration. Thus, with different scenarios, there will not be a single base case prescribing the exact amount at which the fee should be set. Judgments will have to continue to be made about when and if the fee should be changed and/or an indexing system should be implemented. However, the use of a base-case inflation rate will provide the most probable case for the future and will help put into perspective the analysis of the sensitivity of fee adequacy to higher and lower rates of inflation. This would provide the Congress and other interested parties with a better understanding of the rationale DOE uses in arriving at its annual fee-adequacy determination.

Finally, now that the President has decided that DOE will dispose of its defense waste in one or more civilian repositories and DOE has selected a cost-allocation method, DOE is legally required to pay the cost of disposing of its nuclear wastes before such disposal occurs. In addition, the amounts of DOE's share of program costs incurred since NWPA was enacted and its share of future program costs can be estimated using DOE's cost allocation method. Therefore, DOE needs to disclose its current share of program costs in its defense programs budget submissions and annual financial statements on the Nuclear Waste Fund. Budgetary disclosure is needed by the administration and the Congress to determine appropriate levels of revenues and expenditures and to establish national budget priorities, particularly in view of the requirement for funds to operate, modernize, and clean up DOE's nuclear weapons complex. Also, recognizing the amount of the defense-waste share of costs, rather than just DOE's obligation to pay this share, provides a mechanism for formally applying and disclosing the results of OCRWM's cost allocation methodology.

Recommendation to the Congress

We recommend that the Congress amend the Nuclear Waste Policy Act of 1982 to authorize the Secretary of Energy to automatically adjust the nuclear waste disposal fee that utilities pay into the Nuclear Waste Fund on the basis of the annual rate of inflation.

Recommendations to the Secretary of Energy

If the Congress authorizes the Secretary of Energy to implement a system to automatically adjust the civilian waste disposal fee each year based on an appropriate inflation index, we recommend that the Secretary use a realistic base-case inflation-rate estimate to determine when the system should be implemented.

We also recommend that the Secretary of Energy record DOE's liability for its share of waste program costs in DOE's financial records and reports, and recognize the amount owed by DOE in the annual financial statements of the Nuclear Waste Fund. Finally, the Secretary should include the government's contingent liability for future defense waste disposal costs in DOE's financial records and reports.

Agency Comments and GAO Evaluation

In concurring with our recommendation to the Congress on the need to authorize a fee-setting mechanism that would automatically adjust the fee based on an inflation indexing system, DOE said that automatic indexing would provide (1) more equality in the treatment of current and future ratepayers and (2) the utilities with a predictable method of planning for future fee increases. Nevertheless, it said that it has not yet reached a conclusion about whether such an adjustment is necessary. Moreover, DOE said that while it also concurs with our recommendation to use a base-case inflation rate to determine when the inflation indexing system should be implemented, its approach to identifying the base case differs from what we recommended. DOE considers it more useful to use a probable range of inflation rates, rather than a single rate, as its base case. This, it said, is because the inflation rate projections must be made for 85 years. Finally, DOE said that it will clearly identify the ranges it uses in its future fee-adequacy assessment reports.

We consider the proper treatment of inflation to be one of the most critical elements in ensuring that the waste fee is adequate to cover program costs. To help avoid a funding shortfall in the Nuclear Waste Fund, we are recommending that a single inflation rate be used as a base case. We recognize, however, that the sensitivity of DOE's projections would have to be tested by using inflation rates both above and below the base case rate. As we point out in our report, DOE management will need to continue exercising judgment in determining when and if the fee should be changed and/or an indexing system should be implemented.

DOE has chosen to treat inflation as a part of its overall fee assessment process rather than including inflation as a part of its cost estimate. This treatment of inflation is satisfactory, but it should be remembered that if inflation were considered in estimating costs, a single rate would be applied. In fact, if an indexing system is implemented, the analysis of fee adequacy can be performed in real terms because the fee is effectively stated in constant dollars. On the assumption that real interest rates remain approximately constant, this real-term analysis entirely eliminates the general inflation rate as an issue in fee adequacy, leaving

only the real (constant dollar) costs of the program as the basis for discretionary adjustment of the fee. Finally, DOE's concern about the need to make an 85-year projection of the inflation rate is not a significant problem because, as we point out in the report, the projected rate could be adjusted if warranted during the annual assessments.

Until DOE issues its fee assessment report, which it expects to do late this spring, we will not be able to determine whether DOE's approach will produce similar or significantly different results than the approach we are recommending. Although there may be questions about what the future holds in terms of the rate of inflation, there is little question that inflation will occur. Accordingly, if and when the Congress authorizes an inflation indexing system, we believe that DOE will have to take prompt action to begin to cover this cost element. If the Congress does not authorize such a system, an alternative means of covering the rising costs of inflation will have to be found.

DOE said that it concurs in principle with our recommendations on recording DOE's actual and contingent liability for its share of waste program costs in its financial records and reports. DOE said, however, that the appropriate recording and reporting treatment for large, long-term, unfunded liabilities is a government-wide issue that must be resolved before DOE takes action on our recommendations.

DOE owed the Nuclear Waste Fund $483 million for its share of program costs as of September 30, 1989. There is no question that this amount is a liability and should be recorded and reported as such. In regard to DOE's long-term contingent liability, we believe that our recommendations are valid and that, in the interest of full disclosure, DOE should implement them.

Criteria Basic to an Effective Cost-Estimating Process

These criteria were first published in our report entitled Theory and Practice of Cost Estimating for Major Acquisitions (July 24, 1972, B-163058).

Clear Identification of Task

To prepare a cost estimate, the estimator must be provided with the system description, ground rules and assumptions, and technical and performance characteristics of the system. A well-defined system description that specifies conditions and constraints of the estimate is essential in clearly identifying the scope of the estimate and documenting how it was prepared.

Broad Participation in Preparing Estimates

The acquisition of a major system[1] involves many agency and contractor organizations in deciding mission need and requirements and defining performance parameters, force structures, and other system characteristics for a given project. The cost estimate should ensure that all organizations that have an input into the system design have participated in preparing the project cost estimate. Each organization should have had its data independently verified for accuracy and completeness and have cost controls in place to ensure the reliability of its data.

Availability of Valid Data

Numerous sources of data are available to the cost estimator. These data sources vary in reliability. Historical data bases from which cost estimators project costs of new systems from previously similar or comparable systems are useful data sources. The estimator should use care in determining whether such data are suitable for the purposes identified. The data should reflect current cost trends and be directly related to the system's performance characteristics and specifications.

Standardized Structure for Estimates

There should be a standard method, called a work breakdown structure, for dividing the acquisition effort into specific work packages peculiar to the type of system. The identification of these work packages becomes more detailed as the system progresses through the acquisition cycle.

The work breakdown structure ensures that

[1] A major system is defined as a combination of elements that will function together to produce the capabilities required to fulfill a mission need. The elements may include, for example, equipment, construction, real property, hardware, or improvements.

(a) estimates can be related to the total program,

(b) relevant cost categories are not omitted,

(c) the estimate can be refined as the system design becomes more defined, and

(d) estimates for similar types of systems can be compared by estimators and decision makers.

An estimate derived from the work breakdown structure assists management in monitoring and directing diverse project activities being contracted by the agencies and the contractors.

Provision for Program Uncertainties

One of the most difficult and often criticized aspects of cost estimating concerns is identifying uncertainties and developing a realistic allowance for their cost impact. Work objectives should be divided into knowns and unknowns and provisions made for their resolution.

Recognition of Inflation

Economic changes over the period of a system's development and acquisition can have a significant effect on the cost to develop, produce, and operate major systems. It is important that inflation be recognized and realistically provided for if estimates for total program costs are to be valid.

Recognition of Excluded Costs

Major system cost estimates should contain provisions for all costs associated with the system. If major costs have been excluded for an estimate or included under another category, it is important that the estimator disclose this information and include its rationale.

Independent Review of Estimates

An independent review of a cost estimate is crucial to the establishment of confidence in the estimate. The independent estimator must examine the original estimate and verify, modify, and correct it as necessary to ensure completeness, consistency, and accuracy of the information contained in the cost estimate.

Revision of Estimates When Significant Program Changes Occur

It is important that cost estimates be updated to reflect changes because changes in the system's design requirements drive the cost. Large changes in the cost of an acquisition significantly influence decisions to continue, modify, or terminate a program.

Department of Energy Comments

Department of Energy
Washington, DC 20585

March 26, 1990

Mr. Victor S. Rezendes
Director, Energy Issues
Resources, Community, and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

The Department of Energy appreciates the opportunity to review the General Accounting Office's (GAO) draft report entitled "Changes Needed in DOE User-Fee Assessments to Avoid Funding Shortfall" (GAO/RCED-90-65).

The Department agrees with the facts presented in the draft report, but disagrees with one of GAO's recommendations. Specifically, the Department does not concur in the recommendation to develop cost estimates for additional scenarios, such as program delays and the contingency that the Yucca Mountain site may be found unsuitable.

In addition, the Department agrees in principle with the two recommendations regarding the recording of liability for its share of the current and contingent waste disposal program costs in its financial reports and statements. However, the appropriate recording and reporting treatment for large, long-term, unfunded liabilities is a Government-wide issue that must be resolved prior to the Department complying with these recommendations.

Detailed comments on the individual recommendations are provided in the enclosure to this letter. I hope that these comments will be useful in preparing the final report.

Sincerely,

John C. Tuck
Under Secretary

Enclosure

DOE COMMENTS ON GAO DRAFT REPORT:
"CHANGES NEEDED ON DOE USER-FEE ASSESSMENTS TO AVOID FUNDING SHORTFALL"
GAO/RCED-90-65

The Department has reviewed the draft report and has the following comments. On page 52 of the report, GAO recommends that, to make the annual cost estimates of the nuclear waste management program more reliable and useful, the Secretary of Energy:

(1) "ensure that the estimates include the costs of all major facilities, tasks, and activities or, if excluded, explain the rationale for such exclusion;

(2) "have estimates made for additional scenarios, such as program delays and a finding that Yucca Mountain would not be suitable for a repository; and

(3) "ensure that all major categories of the estimates include adequate provision for contingencies and that the total portion of the estimates devoted to contingencies be disclosed."

The Department concurs in the first recommendation. Indeed, the Department has included such costs in all previous total system life-cycle cost (TSLCC) estimates to the extent that the necessary information was available. It must be recognized, however, that the waste management program is evolving; information and requirements for the design of the waste management system are still being developed. The TSLCC estimates represent snapshots in time. For each analysis, a cutoff date is defined so that programmatic assumptions are frozen to permit calculation of the TSLCC estimates. For example, the need for a transportation fleet servicing facility had not been determined at the time the assumptions for the May 1989 TSLCC analysis were finalized. The need for this facility will be discussed in the next TSLCC report although it is unlikely that sufficient conceptual design data will be available at that time to allow us to include a cost estimate for this facility. In the future, the Department will discuss the rationale for not including cost estimates for any known system components.

The Department does not concur in the second recommendation. Although the Department has previously performed and will continue to perform analyses of various scenarios, including analyses similar to those suggested in the GAO report, these analyses are performed for the purpose of systems optimization or contingency planning and are not published in the TSLCC report. The Department disagrees that analyses of further schedule delays or of the potential finding of unsuitability of the Yucca Mountain site should be used at this time to analyze the adequacy of the current fee. The Department has recently conducted an extensive review of the program schedule and has revised the planned date for beginning repository operations from 2003 to 2010.

In performing the TSLCC analyses, the Department endeavors to bound the cost estimates over a reasonable range of scenarios. It does not, nor does it believe it should, include cost estimates for the universe of possible scenarios.

The Department concurs in the third recommendation that appropriate contingencies be included in the cost estimates. As the GAO report indicates, the Department has included contingencies in the repository, Monitored Retrievable Storage facility, and transportation cost estimates. An explicit contingency is not identified for the development and evaluation (D&E) cost estimates. The D&E cost estimates for the near term are based on the Department's budget submission. Budget ceilings will not be exceeded; therefore, contingencies on these estimates would not be appropriate. For the years after the budget period, cost projections are based upon the best estimate of program plans and schedules without the benefit of established cost estimating guidelines such as exist for estimating the costs of structures. In making this projection, allowances are made for uncertainty, but without established cost estimating guidelines the uncertainty is difficult to define explicitly. In the future, the Department will reevaluate the feasibility of a more explicit contingency in the D&E cost category.

The Department's practice has been to discuss contingencies in the backup documents to the TSLCC report. In the future the Department will discuss contingencies in the TSLCC report itself.

Pages 75 and 76 of the GAO report contain the following additional recommendations:

(4) "...that the Congress amend the Nuclear Waste Policy Act of 1982 to authorize the Secretary of Energy to automatically adjust the nuclear waste disposal fee that utilities pay into the Nuclear Waste Fund on the basis of the annual rate of inflation."

(5) "...that the Secretary use a realistic base-case inflation rate estimate to determine when the system should be implemented."

(6) "...that the Secretary of Energy record DOE's liability for its share of waste program costs in DOE's financial records and reports, and recognize the amount owed by DOE in the annual financial statements of the Nuclear Waste Fund."

(7) "...the Secretary should include the government's contingent liability for future defense waste disposal costs in DOE's financial records and reports."

The Department concurs in the fourth recommendation in the sense that if and when an adjustment is found to be necessary, automatic adjustments appear to be the appropriate mechanism. The Department has not yet reached a conclusion as to whether such an adjustment is necessary. The Department has indicated in its annual fee adequacy reports that indexing the fee to inflation, rather than proposing larger, less frequent fee adjustments, is the preferred method when fee adjustments are needed. Legislation authorizing automatic indexing would provide more equality in the treatment of current and future ratepayers and would also provide the utilities with a predictable method of planning for future fee increases.

The Department concurs in the fifth recommendation that a base-case inflation rate should be used in arriving at a decision on the need to adjust the fee. However, the Department's approach to identifying the base case differs from that recommended. The Department considers it more useful to utilize a basecase (probable) range of inflation rates rather than a single rate since the projections are for 85 years. In past reports the Department has not clearly identified the ranges that it considers probable for decision purposes, but will do so in future reports.

The Department concurs in principle with the sixth and seventh recommendations. However, the appropriate recording and reporting treatment for large, long-term, unfunded liabilities is a Government-wide issue that must be resolved prior to the Department complying with these recommendations. Section 8(b)(2) authorizes the Department to make payments to the Nuclear Waste Fund. In the total system life cycle cost report ("Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program," dated May 1989) and the fee adequacy report ("Nuclear Waste Fund Fee Adequacy: An Assessment," dated June 1987) the program has provided its estimate of the defense high-level waste cost share of total system costs.

The Department appreciates the perspective of the GAO on these matters and hopes that these comments will be helpful in preparation of the final report.

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