



**Department of Energy  
Washington, D.C. 20585**

July 26, 1984

Gentlemen:

I am pleased to enclose the recently completed report entitled Nuclear Waste Fund Fee Adequacy: An Assessment. The Nuclear Waste Policy Act of 1982 (Public Law 97-425) requires the Secretary of Energy to annually review the user fees established under the Act in order to determine if the fees will provide sufficient revenues to cover the costs of the Civilian Radioactive Waste Management Program administered by the U.S. Department of Energy. This is the second annual report summarizing the results of that review.

This report was prepared by the Office of Civilian Radioactive Waste Management (OCRWM). It summarizes the results of a recent analysis used to evaluate whether the revenues resulting from the mandated 1.0 mill per kilowatt hour fee will be sufficient to offset the costs of disposal of commercially generated spent nuclear fuel and solidified high-level radioactive waste.

This report will be superseded by a more extensive report in January 1985. The next report will reflect the content and direction of the nuclear waste management program described in OCRWM's Mission Plan For The Civilian Radioactive Waste Management Program, scheduled to be submitted to the Congress later this year. I hope you will find this interim report useful, and I welcome your comments and suggestions.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert H. Bauer".

Robert H. Bauer  
Associate Director for  
Administrative Management  
Office of Civilian Radioactive  
Waste Management

Enclosure:

Nuclear Waste Fund Fee Adequacy: An Assessment

**NUCLEAR WASTE FUND FEE ADEQUACY:**  
**AN ASSESSMENT**

**July 1984**

**U.S. DEPARTMENT OF ENERGY**  
**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**  
**WASHINGTON, D. C. 20585**

## INTRODUCTION AND SUMMARY

This is the second report <sup>1/</sup> of an annual series that evaluates whether the revenues collected from the waste disposal fees established under Section 302 of the Nuclear Waste Policy Act of 1982 (Public Law 97-425) are sufficient to offset the Federal government's costs for the disposal of commercially generated spent nuclear fuel (SNF) and high-level radioactive waste. Nuclear wastes produced from defense activities are not considered in this report.

The principal findings of this year's analysis are noted below:

- o The current 1.0 mill per kilowatt-hour (kwhr) fee is projected to produce revenues sufficient to offset total system life cycle costs associated with the cases specified later in the report, assuming that the average annual rate of inflation does not exceed 2 to 3 percent.
- o Higher average annual rates of inflation, or unanticipated real cost growth, would cause cumulative program costs to approach and then surpass cumulative revenues generated from the current 1.0 mill per kwhr fee.
- o Based on an analysis of different inflation rates and program cost growth projections discussed herein, indexing of the fee to correct for inflation would not need to begin until 1985, at the earliest, or perhaps as late as the year 2000.
- o There is substantial uncertainty about both the program cost and revenue projections. However, more reliable data are expected to become available in the late 1980s as the program evolves from its present conceptual design phase to the engineering phase. Hence, any recommendation to raise the 1.0 mill per kwhr fee before that time should be measured against the uncertainties that attend the present program.

## BACKGROUND AND LEGAL REQUIREMENTS

The Act prescribed that the owners and generators of commercially generated nuclear waste will pay the full costs of its disposal. The Act also established a Nuclear Waste Fund (NWF) to ensure the full cost recovery funding of a safe and environmentally acceptable program. This fund is composed of the revenue from an

adjustable fee charged quarterly for all electricity generated by commercial nuclear facilities beginning April 7, 1983, as well as a one-time fee, estimated to produce a total of \$2.3 billion, for nuclear waste produced prior to April 7, 1983. Revenues generated from these two sources, as well as interest earnings accruing from the investment of Fund surpluses in U.S. Treasury securities, are deposited to the NWF, and disbursements are made as the program progresses.

The Act also created a new Office of Civilian Radioactive Waste Management (OCRWM) under the U.S. Department of Energy (DOE) to administer applicable provisions of the legislation, including Section 302(a)4 that calls for an annual review of the adequacy of the waste disposal fees to recover waste disposal program costs. Based on the results of the evaluation, the ongoing fee may be adjusted, if necessary.

The analysis discussed in this report examined both the costs and financing of the civilian nuclear waste management program described in DOE's preliminary working draft Mission Plan of December 1983. <sup>2/</sup> However, the Mission Plan has since been revised extensively in response to internal and public comments. The present formal draft of the Mission Plan of April 1984 <sup>3/</sup> departs appreciably in several technical related aspects from the December version of the Plan, and the estimation of the costs associated with this revised program has not been completed. Thus, the findings offered in this report should be viewed as interim. Work is underway to publish a fee adequacy evaluation report in January 1985 that will be consistent with the version of the Mission Plan that is to be submitted to the Congress. DOE intends to follow the January publication date for all future fee analysis reports.

#### METHODOLOGY AND ASSUMPTIONS

This evaluation of fee adequacy is based on the principle of "full-cost recovery", which means that the Federal government should be reimbursed for all costs related to the waste disposal services it provides to the signatories of DOE's "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste." <sup>4/</sup> The principle of full-cost recovery underlies the basic analytic approaches used by DOE in 1978, 1980 and 1983 to evaluate financing methods suited to a Federally administered civilian nuclear waste management program.

The general methodology employed in this year's report projects Nuclear Waste Fund cash flows and resulting balances based on program costs and revenues, including interest earnings and expenses. A 2 percent real interest rate was assumed. If the projected final Fund balance is estimated to be positive, then the

fee is judged adequate to ensure full cost recovery. If the projected final Fund balance is estimated to be negative, then the converse would be true.

The principal assumptions used in this report to produce the reference case estimates are noted below:

- o Spent fuel cumulative discharge through the year 2020 - 134,000 metric tons uranium (MTU)
- o Number of geologic repositories - Two
- o Repository design capacity - 70,000 MTU each
- o Repository receipt rates - 1,800 MTU/Yearly for the first five years, and then 3,000 MTU/Yearly thereafter.
- o Minimum cooling time since discharge of spent fuel accepted for disposal - 10 years
- o Operational start-up dates for the repositories - First one in 1998 and the second one in 2003

Several alternative program cases (i.e. sensitivity cases) were also studied to determine the sensitivity of the reference case cost estimates to different programmatic assumptions. The assumptions for these alternative cases diverge from the assumptions noted above with respect to: 1) the inclusion of a five year repository schedule delay and construction of monitored retrievable storage facilities to accomodate the spent fuel flow; 2) both higher and lower program construction and operations costs arising from either unanticipated technical difficulties or the use of more efficient designs; and 3) lower nuclear growth projections resulting in declining revenue and SNF discharge forecasts.

The revenue projections used in this analysis were derived from estimates of gross electricity generation prepared in September 1983 by the U.S. Energy Information Administration (EIA). Three nuclear growth scenarios are depicted in this report: 1) The "Firm-Base" case assumes all reactors currently under construction but less than 30 percent complete are cancelled, and no orders for new reactors are placed. The net effect is that when the reactors now more than 30 percent complete begin operation by about 1990, the number of nuclear power plants is stable for about 10 years,

and then declines to zero in 2020 as plants are retired. 2) The "Low" case makes the same assumptions about the completion of reactors now under construction as in the "Firm Base" case, but also assumes a slow increase in installed nuclear capacity through the year 2020. 3) The "Mid" case assumes the market share of commercial nuclear power grows at a moderate rate, resulting in an approximate doubling of installed nuclear capacity between 1990 and 2020. EIA's "High" growth case was not included because the implied accelerated development of commercial nuclear power during the next two decades appears highly unlikely.

The total system life cycle costs of the civilian nuclear waste management program analyzed in this report are organized into three major categories that retain the costing structure used in last year's fee analysis report. These categories are: 1) development and evaluation; 2) geologic repository construction, operations, closure and decommissioning; and 3) transportation and systems development.

It should be noted, however, that the cost estimates are based largely on conceptual designs, with definitive information still lacking in many areas. The estimates will be refined as new information becomes available.

Four candidate geologic media (i.e. basalt, bedded salt, domed salt and tuff) are being considered as host rocks for the first repository. For purposes of this fee adequacy analysis, granite is assumed to be the geologic medium for the second repository.

#### ANALYSIS

This section of the report discusses both revenue and program cost projections and assesses the adequacy of the current 1.0 mill per kwhr fee to recover program costs.

Cumulative revenues derived from the three EIA electricity generation cases discussed in this report, based on the continuing application of the current fee, are as follows: 1) Firm-Base case - \$19.7 billion; 2) Low-case - \$26.8 billion; and 3) Mid-case - \$33.3 billion. Interest earnings amounting to several billion dollars would also accrue to the Nuclear Waste Fund during those years when program revenues are expected to exceed program costs.

Life cycle costs associated with development and evaluation cover all the siting, testing, design development, regulatory and institutional activities relating to the two geologic repositories, monitored retrievable storage facilities, other facilities and the required transportation network. These costs are estimated at \$7.6 billion, expressed in 1983 dollars.

Reference case, life cycle transportation costs reflect the use of currently licensed transportation canisters, technology, and procedures to ship spent nuclear fuel from individual commercial reactor storage sites to regionally located repositories. These costs range from \$2.5 billion to \$3.5 billion, depending on the assumed locations of the two repositories.

The candidate geologic media directly influence the activities, and hence costs, associated with the construction and operation of the two repositories. For example, repository site characterization and waste package design activities are tailored to meet the regulatory standards that govern the emplacement of nuclear waste in each of the candidate media. As a result, total life cycle cost estimates vary noticeably from host rock to host rock, with the overall difference amounting to about 35 percent (i.e. \$5.2 billion to \$7.0 billion). The following table displays the total life cycle cost data for the reference case waste disposal program.

Table 1. Summary of Reference Case Total System Life Cycle Costs Through the Year 2040 (Billions of 1983 dollars)

Host Rock for First Repository	Development and Evaluation	Transportation	First Repository	Second Repository (Granite)	*Total
Basalt	\$7.6	\$3.5	\$7.0	\$5.3	\$ 23.3
Bedded Salt	7.6	2.8	5.5	5.3	21.2
Dome Salt	7.6	2.5	5.6	5.3	20.9
Tuff	7.6	3.4	5.2	5.3	21.4

Cost sensitivity cases were studied for the three EIA spent fuel discharge and electricity generation forecasts described earlier in the report. For each growth projection, total system life cycle costs were estimated for the four different first-repository host rocks, paired with a second repository of granite. The cost ranges in Table 2 show the cost estimates for the lowest- and highest-cost pairs of media.

\* The sums of the costs do not equal the totals due to rounding.

Table 2. Summary of Sensitivity Cases:  
Total System Life Cycle Costs Through the Year 2040  
(Billions of 1983 dollars)

Electricity Generation Case	Alternate Program Cases		
	Low Cost Cases	High Cost Cases	Schedule Delay (5 Years)
Firm Base	\$ 17.6	\$19.9	-
Low	19.6	22.7	-
Mid-Reference	20.9	23.3	\$24.3 - 27.8

The final balances of the Nuclear Waste Fund are extremely sensitive to the effects of compounded annual inflation. With no inflation, the Fund balance in the year 2040, which is the last year of the program analyzed in this report, is positive for all cases discussed in this report. However, as the assumed rate of inflation rises, the estimated final Fund balance declines. Expressed in constant 1983 dollars, the Fund balance for the reference case program could reach a cumulative deficit of \$6 billion in the year 2040 with sustained 3 percent inflation and selection of the highest-cost pair of repository media. That deficit could grow to \$15 billion with 5 percent inflation. Under the Low case assumptions, the cumulative Fund deficit would reach \$16 billion with 5 percent inflation. The following table illustrates this phenomenon.

Table 3. Final Nuclear Waste Fund Balances Through the Year 2040  
(Billions of 1983 dollars)

Electricity Generation Cases	Program Cost Category	Annual Rate of Inflation (In Percent)			
		0	2	3	5
Mid-Reference	Low	\$26	\$ 7	\$ 1	\$ -9
	High	20	1	-6	-15
Low	Low	15	2	-4	-11
	High	10	-4	-9	-16
Firm-Base	Low	6	-2	-6	-11
	High	2	-7	-10	-15

If the "High-Cost" category cases noted above bound the upper limits of program cost uncertainty, then adjusting the current fee to keep pace with inflation would solve the problem of trust fund deficits. The year in which the fee should begin to be adjusted for inflation is complicated, however, by the fact that OCRWM will not know until the late 1980s which nuclear growth scenario is credible. Fortunately, most of the program costs and revenues occur after 1990. Both inflation and real cost estimates will be in better perspective after that date. As a result, it is prudent to delay a decision to adjust the fees until confirmatory data are available. Nevertheless, Table 4 identifies, for several example rates of inflation, the years in which the fee should begin to be adjusted by indexing it to inflation.

Table 4. Year to Begin Indexing the Waste Disposal Fee  
(Assuming different inflation rates)

Electricity Generation Cases	Program Cost Category	Annual Rate of Inflation (In Percent)		
		2	3	5
Mid-Reference	Low	-	-	1997
	High	-	2000	1992
Low	Low	-	2001	1992
	High	1998	1992	1988
Firm-Base	Low	1996	1991	1986
	High	1986	1985	1985

The Act requires an annual review of the ongoing fee to ensure that the goal of full cost recovery is met. The next report will reevaluate the cases described in this analysis and will consider any new information that potentially affects the integrity of the Nuclear Waste Fund, particularly that stemming from the version of the Mission Plan that is to be submitted to the Congress.

High inflation or real program cost growth could affect the adequacy of the current 1.0 mill per kWhr fee. In fact, one of the concerns expressed in last year's report was the need to exercise stringent cost control over the waste management program. That concern has not diminished. In fact, cost uncertainty was and is deemed by the Department to be the dominant financial hazard confronting the waste disposal program. Rigorous measures to assure fiduciary responsibility and accountability are being introduced.

References

- 1/ U.S. Department of Energy, Report on Financing the Disposal of Commercial Spent Nuclear Fuel and Processed High-Level Radioactive Waste (DOE/S-0020/1), July 1983.
- 2/ U.S. Department of Energy, Mission Plan for the Civilian Radioactive Waste Management Program (Draft), December 1983.
- 3/ U.S. Department of Energy, Mission Plan for the Civilian Radioactive Waste Management Program (Draft) (DOE/RW-0005), April 1984.
- 4/ U.S. Department of Energy, 10 CFR Part 961, Standard Contract For Disposal of Spent Nuclear fuel and/or High-Level Radioactive Waste. Federal Register, April 18, 1983.

Additional copies of Nuclear Waste Fund Fee Adequacy: An Assessment can be obtained by either telephoning (202) 252-5568, direct pick-up at the address shown below, or writing to:

Office of Public Affairs  
Nuclear Waste Fund Fee Adequacy Report  
U.S. Department of Energy  
Room 1E-218  
Forrestal Building  
1000 Independence Avenue, SW  
Washington, D.C. 20585

