

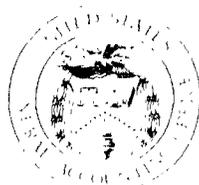
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Briefing Report to the Chairman,  
Subcommittee on Energy and Power,  
Committee on Energy and Commerce,  
House of Representatives

November 1991

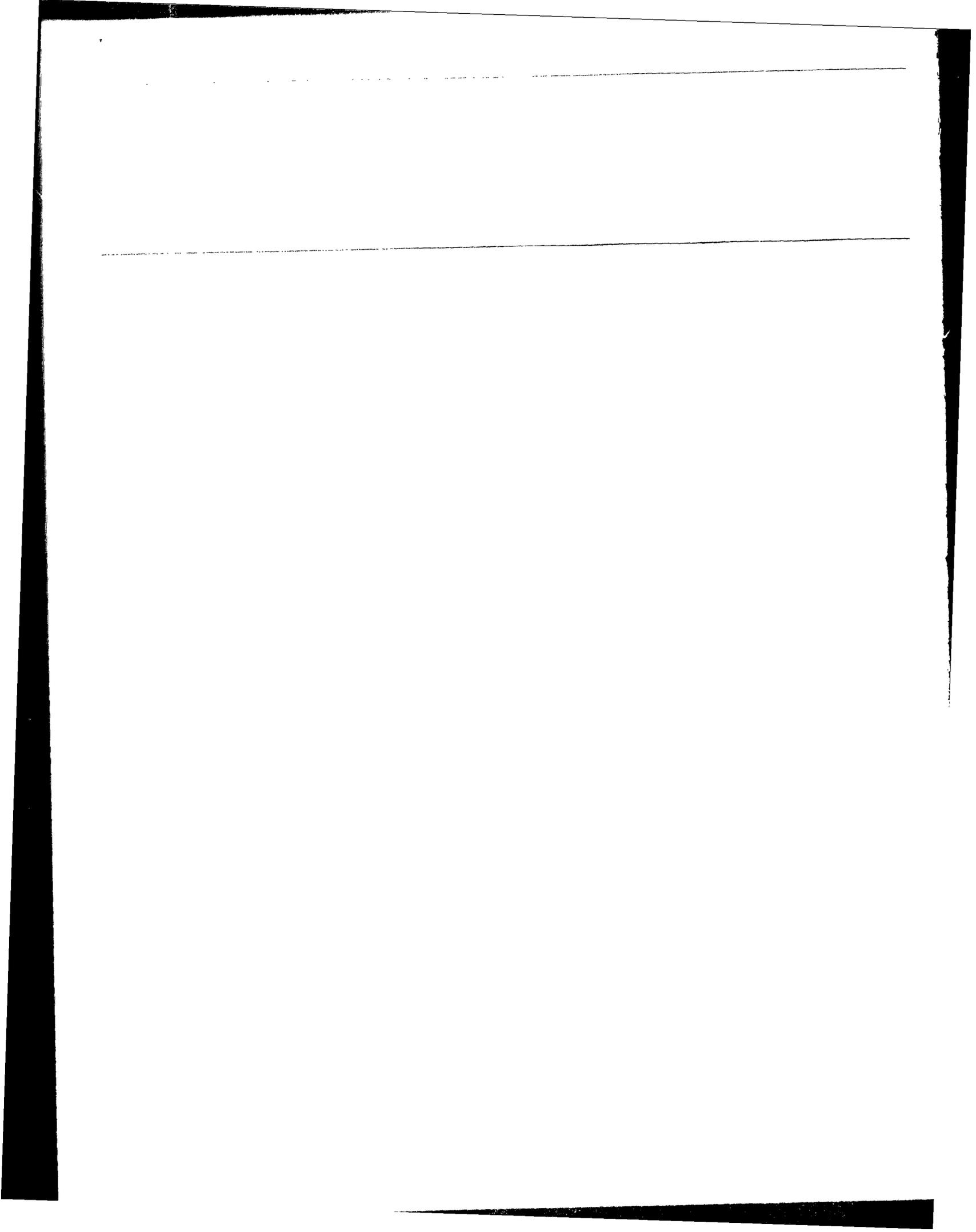
# URANIUM ENRICHMENT

## Analysis of Decontamination and Decommissioning Scenarios



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Resources, Community, and  
Economic Development Division

B-246631

November 15, 1991

The Honorable Philip R. Sharp  
Chairman, Subcommittee on Energy and Power  
Committee on Energy and Commerce  
House of Representatives

Dear Mr. Chairman:

This report responds to your request that we analyze under four different scenarios the adequacy of a \$500 million annual deposit into a fund to pay for the cost of cleaning up the Department of Energy's (DOE) three aging uranium enrichment plants. These plants are located in Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. On October 16, 1991, we briefed your office on the preliminary results of our analysis of that funding method. This briefing report documents the information we provided at that meeting.

In summary, we found the following:

- A fixed annual \$500 million deposit made into a cleanup fund would not be adequate to cover total expected cleanup costs, nor would it be adequate to cover expected decontamination and decommissioning (D&D) costs.
- A \$500 million annual deposit indexed to an inflation rate would likely be adequate to pay for all expected cleanup costs, including D&D costs, remedial action, and depleted uranium costs.

BACKGROUND

In order to analyze the funding proposal, we developed a computer model to track annual fund deposits, withdrawals, and ending fund balances. The model shows the annual cash flows for the proposed cleanup fund through 2030, the expected period for D&D cleanup operations, and through 2040, the expected period for completion of cleanup operations at the three plants. The model can be used to predict whether a given stream of annual deposits into the fund would be sufficient to pay for expected future expenses. Key inputs into the model include (1) annual deposits into the fund, (2) annual expenses paid by the

fund, (3) an investment rate used to calculate interest on fund balances, and (4) an escalation (inflation) rate used to adjust future cleanup costs, which were provided by DOE in 1992 dollars.

Cleanup cost estimates and the timing of those expenses were taken from several sources, with all sources presenting their estimates in 1992 dollars. Estimated cleanup costs were taken from DOE contractor reports, while preliminary timing of these costs was provided to us separately by the contractors. D&D costs for cleaning buildings and equipment used in uranium enrichment are expected to cost about \$16.1 billion but could increase as much as 50 percent or decrease as much as 30 percent, according to an Ebasco Services, Incorporated, report. Remedial action costs for cleaning up the surrounding ground and water are estimated at about \$3 billion, according to a draft report prepared by Martin Marietta Energy Systems. Cleanup costs for converting and disposing of low-level radioactive uranium waste streams are expected to be \$1.9 billion (with a range from \$1.3 billion to \$4.1 billion), according to another draft report prepared by the same contractor.

Because of time limitations, our analysis used some preliminary DOE contractor information on the timing and amount of cleanup costs. DOE contracted for the Ebasco and Martin Marietta studies to serve as a basis for its report to the Congress on total enrichment plant cleanup costs. DOE was to provide this report to the Congress by September 30, 1991, but as of November 8, 1991, had not done so. Furthermore, we have not fully evaluated the adequacy of the contractor cost estimates. We note that the D&D and remedial action estimates are based on limited site characterization work to determine the extent of contamination and on many assumptions that we plan to critique in our detailed report. In addition, these estimates do not include the cost to clean up DOE's gaseous centrifuge buildings, a cost roughly estimated by DOE to be \$50 million. However, in our view, the cost estimates are the best available and should provide a reasonable indication of the magnitude of annual deposits needed to pay for future cleanup expenses to comply with current environmental laws.

#### FUNDING SCENARIOS ANALYZED

We analyzed four funding scenarios to determine whether a \$500 million stream of annual deposits into a cleanup fund

would be sufficient to pay for expected future cleanup expenses.

The four scenarios we analyzed were the following:

- first, a fixed annual \$500 million deposit into a fund to cover estimated D&D costs;
- second, a \$500 million annual deposit indexed to an inflation rate to cover estimated D&D costs;
- third, a fixed annual \$500 million deposit into a fund to cover total estimated cleanup costs (i.e., D&D remedial action and depleted uranium costs); and
- fourth, a \$500 million annual deposit indexed to an inflation rate to cover total estimated cleanup costs.

We evaluated each scenario using two sets of investment and escalation rate assumptions: a 6-percent investment rate with a 3-percent escalation rate (case 1), and a 7-percent investment rate with a 4-percent escalation rate (case 2). Fund deposits are assumed to start in 1993 and continue for as long as cleanup costs are expected to be incurred.

In brief, for the first scenario, we found that if a fixed annual \$500 million deposit was made into a fund, the collected amount plus interest would not be adequate to cover expected D&D costs under either set of rate assumptions. Therefore, the cost of all cleanup expenses under the third scenario would clearly not be met by a \$500 million annual deposit.

However, we found that if the second scenario is followed and the \$500 million deposit is indexed to the annual inflation rate, adequate funding would be provided--with a remaining balance in 1992 dollars of \$7.3 billion for case 1, which uses a 6-percent investment rate and a 3-percent escalation rate, and \$7.1 billion for case 2, which uses a 7-percent investment rate and a 4-percent escalation rate. In this regard, we found that a \$400 million annual deposit indexed to either set of rate assumptions would provide adequate funds--with a remaining balance in 1992 dollars of \$288 million for case 1 and \$48 million for case 2--to pay for expected D&D costs should an initial deposit of less than \$500 million be desired.

We also found for the fourth scenario that a \$500 million initial deposit that is indexed to the annual inflation rate would provide adequate funding for all expected cleanup costs--with a remaining balance in 1992 dollars of \$3.3 billion for case 1, which uses a 6-percent investment rate and a 3-percent escalation rate assumption, and \$3.2 billion for case 2, which uses the 7-percent investment rate and the 4-percent escalation assumption. However, during a part of the cleanup period under each case, the cleanup fund would not contain sufficient money to pay total expected costs and would have to borrow funds to meet these costs. By about 2036, the fund would accumulate enough money through continued annual deposits to pay all costs, including all loans and related interest. Section I provides a more detailed summary of the results of our analysis.

As requested, we did not obtain written agency comments for this briefing report. We conducted our work in October 1991 in accordance with generally accepted government auditing standards. Unless you publicly announce its contents earlier, we plan no further distribution of this briefing report for 30 days from the date of this letter. At that time, we will send copies to appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

If you have any questions, please contact me at (202) 275-1441. Major contributors to this briefing report are listed in appendix I.

Sincerely yours,



Victor S. Rezendes  
Director, Energy Issues

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ABBREVIATIONS

D&D	decontamination and decommissioning
DOE	Department of Energy
GAO	General Accounting Office

SECTION 1  
RESULTS OF ANALYSIS

This section provides the detailed results of our analysis of whether a given stream of annual deposits made into a uranium enrichment cleanup fund would be sufficient to pay for expected future cleanup expenses. For the purposes of this analysis, total cleanup costs are divided into three types: (1) decontamination and decommissioning (D&D), (2) remedial action, and (3) depleted uranium costs. Cleanup cost estimates and the timing of those expenses were taken from several sources, with all sources presenting their estimates in 1992 dollars.

D&D costs for removing radioactive and hazardous materials and decontaminating the facility buildings were taken from a September 1991 report entitled Preliminary Cost Estimate Decontamination & Decommissioning of the Gaseous Diffusion Plants, prepared for DOE by Ebasco Services, Incorporated, DOE's Oak Ridge Operations Office architectural and engineering contractor for environmental restoration projects. According to the report, expected D&D costs would amount to \$16.1 billion, but could increase as much as 50 percent or decrease as much as 30 percent. Therefore, we determined D&D costs to range from \$11.25 billion to \$24.15 billion.

For the expected cost of remedial action--cleaning up the ground and water surrounding the facilities--we used a \$3.0 billion estimate developed in a September 1991 draft report entitled Department of Energy Gaseous Diffusion Plants Assessment of Costs for Remedial Actions. This report was prepared for DOE by Martin Marietta Energy Systems, DOE's management and operating contractor for DOE's three uranium enrichment plants. These plants are located in Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio.

For the expected cost of disposing of depleted uranium, we used the estimate of \$1.9 billion (with a range from \$1.3 billion to \$4.1 billion), developed in another September 1991 draft report prepared for DOE by Martin Marietta Energy Systems, entitled Cost Study For The D&D of The GDPs Depleted Uranium Management and Conversion.

We analyzed four funding scenarios to determine whether a \$500 million stream of annual deposits made into a cleanup fund would be sufficient to pay for expected future cleanup expenses. First, we evaluated whether a fixed annual deposit into the fund would be sufficient to pay only D&D expenses. Second, we indexed the annual fund deposit to the inflation rate to see if the resulting fund balance would cover expected D&D costs. Finally, we examined the effect of adding remedial action and depleted uranium cleanup costs to D&D costs.

The following are the four scenarios we analyzed:

- first, a fixed annual \$500 million deposit into the fund to cover estimated D&D costs;
- second, a \$500 million annual deposit indexed to an inflation rate to cover estimated D&D costs;
- third, a fixed annual \$500 million deposit into the fund to cover total estimated D&D, remedial action and depleted uranium costs; and
- fourth, a \$500 million annual deposit indexed to an inflation rate to cover total estimated D&D, remedial action and depleted uranium costs.

Fund deposits are assumed to start in 1993 and continue for as long as cleanup costs are expected to be incurred. For scenarios one and two, which include only D&D costs, fund deposits continue through 2030, when D&D is expected to be completed. Because other cleanup costs are expected to run through 2040, annual deposits to the cleanup fund would continue through that year for scenarios three and four. The model escalates cleanup costs provided in 1992 dollars to that of the year they are expected to be needed and calculates interest earned on outstanding annual fund balances at a certain investment rate. Interest on fund balances accrues on a monthly compounded basis. For each scenario we used two sets of escalation and investment rate assumptions: a 6-percent investment rate with a 3-percent escalation rate (case 1) and a 7-percent investment rate with a 4-percent escalation rate (case 2).

To evaluate the adequacy of the cleanup fund, we calculated the (1) actual fund ending balance, (2) ending balance adjusted in 1992 dollars, and (3) ending fund balance adjusted in present value terms. The actual ending balance determines whether sufficient funds are available to meet expected costs. If the ending balance is negative, more money needs to be deposited to meet expected costs. If the ending balance is positive, sufficient funds exist; however, a positive ending balance does not necessarily mean the fund maintained a positive balance throughout the cleanup period. To assist in evaluating the size of the ending balance in terms of expected cleanup costs as reported by DOE or its contractors, we converted the ending balance to 1992 dollars. To assist in evaluating the real shortfall or positive balance corrected for inflation expectations and the opportunity cost of investment, we also converted the ending balance to present value terms.

As table 1.1 indicates, for the first scenario, if a fixed annual \$500 million deposit was made into a fund, the accumulated funds would not be adequate to cover expected D&D costs under either set of rate assumptions. Therefore, the third scenario, which includes all cleanup costs, would clearly be inadequate.

However, if the second scenario is followed and the \$500 million deposit is indexed to the annual inflation rate under either set of rate assumptions, adequate funding would be provided--with a remaining balance in 1992 dollars of \$7.3 billion for case 1, which uses a 6-percent investment rate and a 3-percent escalation rate and \$7.1 billion for case 2, which uses a 7-percent investment rate and a 4-percent escalation rate. In this regard, we found that a \$400 million annual deposit indexed to inflation under either set of rate assumptions would provide adequate funds with a remaining balance in 1992 dollars of \$288 million for case 1 and \$48 million for case 2, to pay for expected D&D costs should an initial deposit of less than \$500 million be desired.

For the fourth scenario, table 1.1 also indicates that a \$500 million initial deposit indexed to the annual inflation rate would provide adequate funding for all expected cleanup costs, with a remaining balance in 1992 dollars of \$3.3 billion for case 1 and \$3.2 billion for case 2. However, during the period from 2012 through about 2035, the cleanup fund would not contain sufficient money to pay total expected costs and would have to borrow funds to meet these costs. By about 2036 (after large D&D expenditures have been paid), the fund would accumulate enough money through continued annual deposits to pay all costs, including all loans and related interest. Table 1.1 shows the results of our analysis for all four scenarios.

Table 1.1: Analysis of Funding Scenarios

Dollars in Billions

	<u>Ending balance</u>	<u>Expressed in</u> <u>\$1992</u>	<u>Present value</u> <sup>a</sup>
<u>Scenario one:</u>			
Case 1 <sup>b</sup>	\$(12.8)	\$(4.2)	\$(1.4)
Case 2 <sup>c</sup>	(30.5)	(6.9)	(2.3)
<u>Scenario two:</u>			
Case 1	22.6	7.3	2.5
Case 2	31.6	7.1	2.4
<u>Scenario three:</u>			
Case 1	(73.4)	(17.8)	(4.5)
Case 2	(147.6)	(22.5)	(5.7)
<u>Scenario four:</u>			
Case 1	13.7	3.3	.8
Case 2	20.9	3.2	.8

<sup>a</sup>Present value in 1992.

<sup>b</sup>Case 1: Invest at 6 percent; escalate at 3 percent.

<sup>c</sup>Case 2: Invest at 7 percent; escalate at 4 percent.

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RELATED GAO PRODUCTS

Comments on Proposed Legislation to Restructure DOE's Uranium Enrichment Program (GAO/T-RCED-92-14).

Energy: Bibliography of GAO Documents January 1986-December 1989 (GAO/RCED-90-179, July 1990).

Energy Reports and Testimony: 1990 (GAO/RCED-91-84, Jan. 1991).

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