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BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Secretary Of Energy

Further Improvements Needed In The Department Of Energy For Estimating And Reporting Project Costs

The Department of Energy relies on its regional offices to prescribe guidelines to contractors and its own organizational elements for preparing and reviewing project cost estimates. The Chicago regional office has not issued guidelines and has experienced cost estimating problems. In addition, cost recategorizations and project scope reductions have not been fully reported to the Congress.

GAO recommends that the Secretary of Energy ensure that all regional offices develop and implement guidelines on the preparation and review of cost estimates. GAO also recommends that the Secretary of Energy report to the Congress the magnitude of major project cost recategorizations and scope reductions.



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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

ENERGY AND MINERALS
DIVISION

B-207392

The Honorable James Edwards
The Secretary of Energy

Dear Mr. Secretary:

We examined the Department of Energy's (DOE's) policies, procedures, and practices for estimating the costs of major systems and the accuracy of information provided to the Congress. Our survey focused on two acquisitions in DOE's Chicago Operations and Regional Office--the Transient Reactor Test Facility Upgrade and the Program Support Facility projects. During our survey we found problems with the cost estimating practices, particularly the lack of sufficient guidelines provided to contractors for preparing cost estimates or to DOE's own project officials for reviewing cost estimates. Specifically,

- decisions were based on cost estimates prepared before the projects were sufficiently defined,
- the inflation rates used were too low,
- the provisions for risk were not realistic, and
- the documentation supporting cost estimates was not adequate.

We also found problems in reporting cost changes to the Congress. When estimated project costs exceed appropriated funds, project scope has been reduced or costs have been recategorized without fully notifying the Congress.

Accordingly, we are recommending that you (1) ensure that all regional offices develop and implement guidelines on the preparation and review of cost estimates, (2) identify and report to the Congress the magnitude of major cost transfers between capital and operating funds and major changes in project scope during the past 2 years, and (3) institute tighter controls over project funds by requiring DOE Headquarters review and approval of all cost recategorizations within individual projects. We are also making several recommendations to improve cost estimating within your Chicago Operations and Regional Office.

DOE is aware of its cost estimating problems and has taken some steps to address these problems. However, implementation is in the early stages and we have some reservations as to its overall effectiveness because of its limited scope and lack of enforcement.

DOE officials said that cost estimating for the two projects was not closely monitored since the projects fell below the dollar threshold DOE uses to define its major system acquisitions. DOE Headquarters officials said they had notified the Congress by letter of the cost recategorizations, but the letter only identified a small portion of the costs that were recategorized.

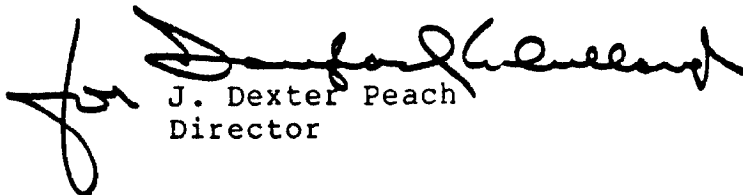
Details of our findings, agency views, conclusions, and recommendations are contained in the appendix.

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As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Director, Office of Management and Budget; the Chairmen, House Committees on Science and Technology, Appropriations, and Government Operations; and the Chairmen, Senate Committees on Energy and Natural Resources, Governmental Affairs, Appropriations, and Appropriations Subcommittee on Energy and Water Development.

Sincerely yours,

A handwritten signature in black ink, appearing to read "for J. Dexter Peach". The signature is written in a cursive, flowing style. To the left of the main signature, the word "for" is written in a smaller, simpler script.
J. Dexter Peach
Director

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SURVEY OF THE ADEQUACY OFDOE'S COST ESTIMATINGPOLICIES, PROCEDURES, AND PRACTICESOBJECTIVES, SCOPE, AND METHODOLOGY

Our objectives were (1) to identify issues associated with DOE's cost estimating policies, procedures, and practices and (2) to determine the accuracy and completeness of cost estimates supplied to the Congress. We did our work at DOE Headquarters in Washington, D.C.; DOE's Chicago Operations and Regional Office in Argonne, Illinois (DOE Chicago); and the operating contractor at Argonne National Laboratory, Argonne, Illinois (Argonne). We reviewed agency policies, procedures, and records related to cost estimating and project management; interviewed DOE Chicago and Argonne officials involved with cost estimating, budget preparation, and project management; and evaluated cost estimates for the Transient Reactor Test Facility (TREAT) Upgrade and the Program Support Facility projects. We selected these two projects because they were among the largest DOE Chicago construction projects.

DESCRIPTION OF THE PROJECTS

The TREAT Upgrade project was originally one of three parts of a \$344 million program initiated in 1976 for doing reactor safety research experiments. Subsequent budget cutbacks forced the canceling of two parts leaving the TREAT Upgrade to do these safety experiments. It is intended to produce information to support the safety review and licensing of future liquid metal fast breeder reactor electric power plants. Argonne has been responsible for preparing DOE budget data for submission to the Congress. Construction costs have risen from an initial estimate of \$27.7 million in 1978 to an estimated \$44.3 million in 1982. We believe that a substantial part of this increase in the cost estimate was caused by poor cost estimating practices. Further, some related construction costs included in the initial estimate were recategorized and are not included in the \$44.3 million. Also, the recategorized items were not reported to the Congress.

The Program Support Facility is a passive solar energy office building being constructed to house DOE Chicago and Argonne administrative staff. Argonne was responsible for preparing the conceptual design and the related budget submittals. The project was funded in fiscal years 1978 and 1979, in the amount of \$15.6 million, its estimated cost. When the building was first funded by the Congress, it was designed as an active solar energy office. However, the solar panels were later deleted from the design to keep the project within the appropriated funds. This reduction in scope was not formally reported to the Congress.

DOE'S COST ESTIMATING SYSTEM
NEEDS TO BE IMPROVED

If DOE management and the Congress are to make informed decisions about DOE projects, realistic cost estimates are essential. Written guidelines on developing cost estimates are necessary ingredients to provide better assurances that comparability, consistency, completeness, and traceability--all factors leading to better management and cost control--are considered when cost estimates are prepared.

DOE Headquarters relies heavily on each regional office to prescribe specific guidelines to contractors and to DOE regional offices for preparing and evaluating project cost estimates. However, it does not have a follow-up system to ensure that regions have carried out these responsibilities. DOE regional offices rely on their operating contractors to prepare cost estimates. The DOE Chicago office has not provided written guidelines to Argonne, its operating contractor, for preparing cost estimates nor has it provided guidance for use by its own project officials in evaluating the adequacy of the contractor's cost estimates. In addition, DOE Headquarters has not determined if each regional office has either developed or used such guidelines. We believe that DOE Headquarters should require its operations offices to develop and implement guidelines for use in cost estimating.

DOE Chicago's cost estimating system does not provide sufficient guidance for preparing cost estimates. The cost estimates for the projects we reviewed showed problems in defining the project, accounting for inflation, handling risk and uncertainty, and documenting cost estimates.

Projects need to be better defined

The project being estimated should be properly defined before an accurate cost estimate can be determined. The TREAT Upgrade project proceeded into development with a marginal conceptual design that required major modifications resulting in an increased cost estimate for the project.

According to DOE Headquarters' officials, they rely on contractors to ensure that projects are properly defined before cost estimates are prepared and funds are requested from the Congress. Contractors generally develop conceptual designs using operating funds. DOE regional officials then review, and if they consider the design reasonable, approve the conceptual design. The Congress provides funding for subsequent work through a line item appropriation. However, because they are competing with other laboratories for an ever decreasing number of dollars, contractors have an incentive to request funding as soon as operating funds allocated to the conceptual design are exhausted, even if the conceptual design is not sufficiently completed.

The initial cost estimate for the TREAT Upgrade program was \$27.7 million in March 1978. In December 1979, a program review meeting established that the TREAT Upgrade conceptual design could not meet functional requirements and indicated very low confidence in the project cost estimate. Extensive modifications and additions to the conceptual design were required to safely and adequately meet the performance capabilities specified for the project. The cost estimate was increased to \$44.3 million in May 1980 and has remained at that figure for 1982.

Project officials said that the primary reasons for increases in estimated costs for the TREAT Upgrade were: (1) Argonne's failure to spend sufficient time on the conceptual design for upgrading the reactor and thus did not identify needed costly modifications, (2) DOE Chicago's acceptance of the contractor's assessment that the project was adequately defined, and (3) inflation, aggravated by project delays, caused increases.

DOE Headquarters in August 1981 drafted a DOE order requiring that conceptual design be 95 percent complete before a budget is submitted. Considering the long lead time required for the budget process, and the need for sufficient funds to prepare the conceptual design at the 95-percent level, we believe the order will be difficult to implement when finalized.

Realistic inflation rates should be used

Cost estimates should provide for a realistic rate of inflation if they are to accurately reflect costs through project completion. Artificially low inflation rates were used in estimating the costs of the TREAT Upgrade project. These low rates have the effect of making the cost estimates lower than they should be.

DOE Headquarters issues overall inflation indexes in support of the budget cycle. These indexes are the escalation rates allowed by the Office of Management and Budget, and are to be used by all DOE offices unless specific justification for a higher rate is provided. Regional office officials can now develop their own inflation estimates if they believe them to be more appropriate to their region. While the methods for constructing inflation indexes are supposed to be validated by DOE Headquarters, this is not done in all cases.

DOE Chicago and Argonne officials said major project cost increases are caused by inflation, the effect of which is exacerbated by reduced funding and project delays. DOE Chicago officials believe that low inflation rates have been used to keep total project costs within budget appropriations. In fiscal year 1979, an inflation rate of 8 percent was applied to the TREAT Upgrade cost estimate, while in fiscal years 1980 and 1981, only 6 percent was applied. During this period the actual national inflation rates were 11.3, 13.5, and 9.9 percent, respectively. DOE Chicago project officials said that they knew the inflation rates used were unrealistic and told DOE Headquarters of their concern with no

result. The inflation rates in Idaho, where the TREAT Upgrade project is located, were higher than the national rate as shown by a 1979 Argonne project document citing a 15.4-percent inflation rate for construction in the Pacific Coast and Rocky Mountain States, a 16.9-percent rate for a waste water treatment center in Idaho, and a 29.1-percent inflation rate for construction in the State of Idaho.

The independent cost estimating staff within DOE Headquarters has developed specific inflation indexes for several DOE laboratories and construction projects. These indexes are scheduled to be used first in preparing the 1984 budget and should be helpful in improving cost estimates provided they are not used to manipulate or control the estimates and they are developed for and required to be used by all laboratories.

Provisions for risk should be more realistic

A contingency allowance should reflect the degree of uncertainty within a project and contain a realistic allowance for cost impact. Work objectives should be divided into known and unknown risks and provisions should be made for the cost of each. Documents should fully reveal all major risks and their cost impact. According to Argonne and DOE Chicago officials, requests for contingency funds are rarely adequate to cover uncertainty and risk because a large contingency fund indicates a level of uncertainty about the project's viability which diminishes its likelihood of receiving funding. As a result, unexpected cost increases are not adequately planned for.

DOE Chicago and Argonne officials could not justify the contingency allowance for either TREAT Upgrade or the Program Support Facility, and felt that both were consistently understated and therefore not realistic. Both DOE Chicago and Argonne officials believed a 100-percent contingency rate would have been more appropriate for certain technical segments of the TREAT Upgrade project considering the early stage of design. Still, a factor of only 25 to 30 percent was used for these segments. The officials said that the low contingency rate was used to keep the project within its approved budget.

The Program Support Facility's conceptual design included a 10-percent contingency factor even though the project involved advanced technology, and a 20- to 25-percent factor would have been acceptable to DOE Headquarters during the conceptual design stage. Unlike most projects where the contingency factor is expected to decline as the project progresses, the contingency factor used in this project increased to 15 percent after the project was funded.

DOE Headquarters issued a draft order in 1981 that established contingency rates to be used in estimating costs for different phases of project completion. However, DOE Chicago and Argonne officials believe that for the conceptual design phase of a project

involving new technology, the contingency rates shown in the draft order were not high enough.

Better documentation needed in support of cost estimates

Cost estimates should indicate the source of the data used and also show how material and labor unit costs and quantities were derived. Cost estimates should also be updated and documented whenever significant changes occur in the project. The reason for revisions to the cost estimate should be explained, such as a change in scope, labor rates, or inflation factors.

Worksheets supporting the cost estimates provided very little documentation for most revisions to the TREAT Upgrade and Program Support Facility cost estimates. For example:

- Deletions and changes to TREAT Upgrade worksheets were not explained. One estimate was changed from \$1.9 million to \$1.3 million without documentary support.
- Totals on the TREAT Upgrade summary schedules did not always equal the amount on the budget request and no explanation was available. The fiscal year 1980 TREAT Upgrade cost estimate for engineering and construction was \$19.6 million, but the worksheets only supported \$15.9 million.
- Documents supporting revisions to the Program Support Facility cost estimates were not available from either DOE Chicago or Argonne.
- Evidence of supervisory review of the cost estimate worksheets of either the TREAT Upgrade or the Program Support Facility was lacking.

BETTER COST DISCLOSURE TO THE CONGRESS IS NEEDED

Congressional committees have encouraged DOE to place all construction related costs into the plant and capital expenditure appropriation because it provides greater management control and congressional oversight. However, DOE Headquarters has a liberal policy on transferring costs from the plant and capital expenditure appropriation to the operating expense appropriation. DOE uses this policy along with scope reductions to keep estimated projects costs within the appropriation. However, the Congress is not always informed of these changes.

The liberal policy on cost reclassifications was used in the TREAT Upgrade project. After the project's construction appropriation had been increased to \$44.3 million, a new cost estimate was developed which estimated \$52.5 million for construction costs. The \$52.5 million was reduced by DOE Headquarters to \$44.3 million and the difference was transferred to operating funds. These

construction costs that were reclassified as operating costs were for items such as the advanced treatment loop, experimental equipment, and a test train handling machine. Although DOE informed the Congress that \$900,000 had been reclassified from construction to operating funds, it did not provide evidence that it had told the Congress of the remaining cost reclassifications. We were told \$8.2 million was reclassified to keep the construction costs within the amount requested of the Congress.

The Congress appropriated \$15.6 million through fiscal year 1979 for the Program Support Facility, which later had some scope reductions that were not reported to the Congress. Solar collector panels had been deleted because the active solar building was converted to a passive solar facility. The graphic arts office was deleted and the computer area was reduced. The health unit and conference rooms were deleted and then added back at an additional cost of \$200,000 and \$130,000, respectively. As a result of these changes, a building of lesser use was acquired. A project official said that an active rather than passive solar energy building would have a better chance of obtaining congressional approval. DOE could not explain why the Congress had not been formally notified of the change to a passive solar energy facility.

VIEWS OF PROGRAM OFFICIALS

We discussed a draft of this report with DOE representatives in Washington, D.C.; the Chicago Operations and Regional Office, Argonne, Illinois; and the operating contractor at Argonne National Laboratory. Their comments have been incorporated throughout the report where appropriate.

DOE Headquarters' officials were concerned that the two examples from DOE Chicago should not be used to generalize on problems in all DOE regional offices. They also pointed out that the two projects were below the DOE dollar threshold used for major system acquisitions (\$75 million for research and development), and therefore, are not closely monitored. They further stated that the TREAT Upgrade project was not a typical project because (1) it was originally a portion of a larger project which was not funded and (2) the operating contractor was an advocate of the project.

We recognize that two projects from DOE Chicago are not sufficient to generalize on problems DOE-wide. However, the fact that these problems exist in one regional office reflects unfavorably on DOE Headquarters' direction and control over its regional offices. This is particularly important where each regional office issues its own guidelines and directions for cost estimating, and headquarters has no procedures to monitor the regions' activities.

The fact that these two projects did not receive the close monitoring given to major system acquisitions is not a valid reason for not following sound management techniques to these acquisitions. We believe these acquisitions are not exempt from

good cost estimating practices that might prevent the problems cited in this report.

DOE Headquarters' officials said they had notified the Congress by letter of the cost recategorizations. We reviewed the letter and found it only explained \$900,000 of the \$8.2 million of recategorized costs. DOE could provide no other evidence that it had informed the Congress of the cost recategorizations.

CONCLUSIONS

DOE Headquarters relies on its regional offices to develop and implement guidelines for cost estimating. However, it has not instituted adequate controls to ensure that the regional offices do so. In the two projects we reviewed DOE Chicago did not provide cost estimating guidelines to the contractor or to organizational elements within the regional office. Since each regional office develops its own cost estimating and review guidelines, DOE Headquarters should ensure the guidelines are developed and implemented. Written guidelines are essential as a first step to ensure that comparability, consistency, completeness, and traceability are considered when cost estimates are prepared.

Cost estimating in the DOE Chicago regional office can be improved by better defining conceptual designs before preparing the cost estimates that are submitted to the Congress. Contractors do not always spend sufficient time in this phase and DOE Chicago does not have adequate controls to ensure that the project is sufficiently defined before accepting the cost estimate. Since DOE Headquarters wants conceptual designs to be 95 percent complete before the budget is submitted, project officials should ensure that this requirement is met before accepting the estimate.

Use of inaccurate and unrealistic inflation estimates have led to increases in cost estimates. Although we recognize that estimating inflation is difficult, DOE has not handled inflation on a consistent basis and in some cases has kept it unrealistically low to keep total estimated project costs within budget appropriations.

Provisions for program uncertainties are also kept unrealistically low to keep the cost estimate as low as possible. If increases in estimated costs are to be kept to a minimum, the risk inherent in each project must be acknowledged and provided for in the budget.

Cost estimates and subsequent revisions are not always adequately documented or explained. Reasons for revising a cost estimate should be made clear in project documentation to ensure the traceability of the cost estimate.

Finally, DOE Headquarters' liberal policy of transferring costs from capital to operating funds has reduced congressional oversight over projects. Scope reductions occurring after congressional approval of a project may sometimes run counter to

the congressional intent. Full disclosure to the Congress is needed to ensure that projects continue to meet the requirements for which they were funded.

RECOMMENDATIONS

To improve the cost estimating system and provide better cost reporting to the Congress, we recommend that you:

- Ensure that all regional offices develop and implement guidelines on the preparation and review of cost estimates.
- Identify and report to the Congress the magnitude of major cost transfers between capital and operating funds and major changes in project scope during the past 2 years.
- Institute tighter controls over project funds by requiring DOE Headquarters review and approval of all cost reclassifications within individual projects.

To improve cost estimating of Chicago's projects, we also recommend that you direct the DOE Chicago Operations and Regional Office to:

- Issue specific cost estimating guidelines.
- Ensure that projects are adequately defined in the conceptual design stage before the cost estimate is submitted to the Congress.
- Require that realistic estimates for inflation are used and consistently followed.
- Allow for adequate provision in cost estimates for program uncertainties, especially in high technology or first-of-a-kind projects.
- Require complete documenting of major revisions to the cost estimate to ensure traceability.

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