



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

**Resources, Community, and
Economic Development Division**

B-282367

April 30, 1999

The Honorable F. James Sensenbrenner, Jr.
Chairman

The Honorable George E. Brown, Jr.
Ranking Minority Member
Committee on Science
House of Representatives

Subject: Fusion Research: Costs of Ending DOE's Participation in the International
Thermonuclear Experimental Reactor Project Appear Reasonable

The International Thermonuclear Experimental Reactor (ITER) project is an international collaborative project undertaken jointly by the countries with the world's leading programs for fusion research. These countries include the United States; Japan; the Russian Federation; and Euratom, a European consortium of nations. The purpose of the ITER project is to demonstrate the feasibility of building a fusion reactor to generate energy for peaceful purposes. The United States has formally participated in the ITER project since 1992 and funds a variety of other activities related to fusion research. The Department of Energy (DOE) manages the U.S. involvement in the ITER project. Concerned that the engineering design chosen for the fusion reactor is too expensive and that insufficient progress has been made in construction commitments and site selection for ITER, congressional conferees directed DOE to end the U.S. role in the ITER project. The conferees provided DOE \$12.2 million in fiscal year 1999 funding to close out its ITER activities. DOE was directed to use these funds to complete the remaining technology research and development and to conduct an orderly closeout of U.S. participation. You asked us to determine if DOE's expenses to close out its participation in the ITER project were reasonable.

In summary, we found that DOE's plans for an orderly closeout of its ITER activities appear reasonable. In addition to the \$12.2 million appropriation, DOE also plans to spend \$7.1 million of fiscal year 1998 funds, bringing the total closeout costs to

162245

\$19.3 million.¹ DOE told us they have a high level of confidence that no additional funds will be needed to close out all remaining ITER-related activities.

Background

Today's nuclear reactors rely on the splitting, or "fission," of heavy elements to release heat that creates steam to drive electric generators. The opposite is fusion, when the nuclei of light elements, such as hydrogen, are forced together under high temperature and pressure. If fusion can be sustained, this process could release large amounts of energy in the forms of heat and radiation. The resulting heat might be used to produce steam for generating electricity. ITER is an experimental fusion reactor based on a particular design concept called the "tokamak." The ITER project arose from the recognition by the countries conducting fusion research that collaboration might result in significant savings by sharing costs and providing an opportunity to learn from the scientific and technical expertise of all the world's leading experts in nuclear fusion. From discussions that began in 1985, a collaboration of four participants—the United States, Japan, the former Soviet Union, and the European Community—was established under the auspices of the International Atomic Energy Agency. Work on conceptual design activities began in 1988. In 1992, the four parties signed an agreement, which established the start of the formal engineering design activities, which were scheduled to last for 6 years until the agreement expired on July 21, 1998. Since 1992, the United States has spent about \$350 million on the ITER project.

Concerned that the reactor design chosen by the countries participating in the ITER project would be too expensive to build—about \$11 billion according to some estimates—the congressional conference committee expressed concern about the value of continued U.S. participation in the project. In the conference report on appropriations for energy and water development for fiscal year 1999, the congressional conferees noted that the ITER agreement had expired in 1998 and directed that DOE not sign an extension of that agreement without the written consent of the authorizing and appropriations committees of the House and the Senate.² Although the conference committee expressed its support for international collaboration in fusion energy, it provided DOE with funds to perform an "orderly completion of research and development of components" in fiscal year 1999. The conference committee also noted that it expected DOE to "meet its commitment to the delivery and testing of the central solenoid model coil," which is an important design component of the experimental reactor. The congressional conferees included \$12.2 million to close out ITER-related activities in fiscal year 1999.

¹DOE is using fiscal year 1998 uncosted obligations, which represent the portion of its budget authority that DOE has obligated for goods and services but for which it has not yet incurred costs. As DOE's contractors receive goods and services, they liquidate or "cost" the obligations. However, not all the obligations are costed during a given year, and these uncosted obligations can accumulate from one fiscal year to the next.

²H.R. Rept. No. 105-749, at 100 (1998).

DOE's Closeout Expenditures Appear Reasonable

The funds DOE has spent and plans to spend to close out its ITER-related activities appear reasonable. Closeout activities include (1) completing technology R&D commitments; (2) implementing the transition of the design engineers and physicists from the Home Team into non-ITER work or, where required, paying severance charges; (3) completing project management activities; (4) returning personnel in the Joint Central Team to their home institutions and implementing their transition to non-ITER activities; (5) and closing down the Joint Work Site in San Diego, California. DOE officials told us that they are confident that no additional funds will be needed beyond those the Congress has already provided to close out all ITER-related activities. Table 1 summarizes DOE's estimates of the costs for these activities.

Table 1: DOE's Estimates of Costs to Close Out ITER-Related Activities, Fiscal Year 1999

Dollars in millions

Account category ^a	Estimated portion of fiscal year 1998 funds needed for fiscal year 1999 closeout activities	Fiscal year 1999 funds provided for closeout activities	Estimated total funds needed in fiscal year 1999 for closeout activities
Home Team			
Technology Research and Development	\$1.7	\$8.8	\$10.5
Design	2.3	0	2.3
Project Management	.1	.3	.4
Joint Central Team			
Secondees ^b	2.7	1.9	4.6
Joint Work Site	.3	1.0	1.3
Joint Fund	0	.2	.2
Total	\$7.1	\$12.2	\$19.3

^aThe Home Team category consists of activities performed by U.S. personnel from DOE's laboratories, educational institutions, and private companies who work at their home institutions. The Joint Central Team category consists of activities involving U.S. personnel who work at the U.S. and overseas Joint Work Sites under the direction of the ITER Director with other ITER staff from participating countries.

^bSecondees are the U.S. personnel assigned to the U.S. and overseas Joint Work Sites.

Source: GAO's analysis of DOE's data.

Of the \$19.3 million that DOE estimates it needs to close out all its ITER-related activities, about half (\$10.5 million) is for the Technology Research and Development account, which has two key activities. The largest activity entails completing the central solenoid model coil and shipping it to Japan for installation in the test facility. This commitment is expected to require \$7.9 million from that account. The coil has been completed and was shipped to Japan in February 1999. Completing and testing the divertor cassette—the other major R&D component to be used in the Japanese test facility—is estimated to require an additional \$.9 million. This cassette will be used in conjunction with the heat transfer plates (which are

being supplied by other participants in the ITER project) to contain the hot plasma generated during a fusion reaction. DOE officials said they were confident that the estimate to close out this second activity would be adequate and that an additional \$1.7 million would be required to close out all the other R&D activities.

The next largest cost estimate is \$4.6 million from the Secondees account to return U.S. scientists and engineers from the Joint Work Sites. As of the end of March 1999, all of these personnel have returned to the United States. Part of the Design account estimate of \$2.3 million includes the cost to transition laboratory and university personnel from their ITER-related activities into U.S. domestic fusion program activities to the extent possible. DOE estimates it will need \$1.3 million to close its Joint Work Site in San Diego, California, and is confident that no additional funds will be needed to complete this task.

To complete R&D activities and to close out U.S. participation in the ITER project, DOE officials anticipate they will need \$7.1 million of fiscal year 1998 funds in addition to the \$12.2 million provided for fiscal year 1999. They will draw these additional funds from the uncosted obligations that had accrued at the end of fiscal year 1998. According to DOE officials, the cognizant congressional committees are aware of their plans to use uncosted obligations for funding fiscal year 1999 ITER-related activities. DOE officials told us that an additional \$1 million in uncosted fiscal year 1998 obligations for the ITER project will not be needed for closeout costs, although additional requirements, such as unanticipated claims from vendors or additional expenses to pay for employees' career transitions, may arise. However, DOE officials told us that they expect much of the \$1 million in remaining uncosted fiscal year 1998 funds to remain unused by the end of fiscal year 1999, the final year of DOE-funded ITER-related activities.

Agency Comments

We provided a draft of this report to DOE for review and comment. DOE expressed concern about our characterization of the ITER project as having technical problems. We accept DOE's explanation that the end of U.S. participation stemmed from the insufficient progress that had been made in construction commitments and site selection for ITER, rather than technical problems, and have changed our report accordingly. DOE also provided a number of clarifications that we have incorporated in our report. Enclosure I includes the full text of DOE's comments.

We conducted our review from December 1998 through April 1999 in accordance with generally accepted government auditing standards. To determine how DOE was using its appropriated funds to close out ITER-related activities, we interviewed officials responsible for the ITER project and examined relevant documents that they provided.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days after the date of this letter. At that time, we will send copies to the Bill Richardson, Secretary of Energy, and Jacob J. Lew, Director, Office of Management and Budget. We will make copies available to other interested parties on request. If you or your staff have any questions about this report, please call me at (202) 512-3841. This report was prepared by Gary R. Boss and Tom Kingham.



Susan Klavits
Associate Director, Energy,
Resources, and Science Issues

Comments From the Department of Energy



Department of Energy

Washington, DC 20585

April 16, 1999

Ms. Susan Kladiva
Associate Director, Energy, Resources
and Science Issues
Resources, Community and
Economic Development Division
U. S. General Accounting Office
Washington, DC 20548

Dear Ms. Kladiva:

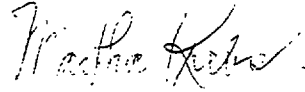
The Department of Energy appreciates the opportunity to review and comment on the General Accounting Office (GAO) draft report entitled: "Fusion Research: Costs of Ending DOE's Participation in the International Thermonuclear Experimental Reactor Project Are Reasonable."

In the opening paragraph a reference is made to Congressional concern that, "...ITER is too expensive and beset with technical problems...." We believe the phrase "technical problems" is misleading because most readers would assume that this includes scientific and engineering problems. From the House Appropriations Committee Report for Fiscal Year 1999, the principal Congressional concerns, in addition to cost, are that insufficient progress has been made by the ITER Parties to commit to construction and to establish a site for ITER. Our suggestion is to mention these latter concerns and not use the phrase "technical problems." In fact, with regard to ITER technical progress, numerous reviews of ITER by scientists and engineers, who come from around the world and who are not directly involved with ITER, have concluded that ITER would be able to meet its mission. Also, these reviews typically conclude that based upon results from the extensive ITER R&D program and from world-wide plasma physics experiments, there is high confidence that the remaining scientific and engineering issues, which are typical of any high technology project, will be resolved satisfactorily.

Minor editorial changes and suggestions for enhanced clarity of the report are provided in the attachment. The Department hopes that these comments will be helpful in preparation of the final report.

If you have any questions, please contact Bonnie Lasky on (301) 903-2158.

Sincerely,



Martha A. Krebs
Director
Office of Science

Attachment

cc:
Juanita McDuffie, Audit Liaison Team

Editorial comments and suggested comments are provided below:

1. Page 1, second paragraph, third line: Change "in" to "of" to provide consistent usage with that on page 4.
2. Page 3, Table 1: The following comments are provided to clarify Table 1:
 - a. Under the main categories of Home Team and Joint Central Team, indent the sub-categories.
 - b. Footnote 1, reference to the Home Team category, should read, "The Home Team category consists of activities performed by U.S. personnel from DOE's laboratories, educational institutions, and private companies working at their home institutions."
 - c. Footnote 1, reference to the Joint Central Team category, should read, "The Joint Central Team category consists of activities involving U.S. personnel working at the ITER Joint Work Sites under the direction of the ITER Director with other ITER staff from participating countries."
 - d. Footnote 2, change the word "personnel" to "Joint Central Team personnel."
 - e. Footnote 3, revise to, "Secondees are the U.S. personnel assigned to the Joint Work Sites."
3. Page 4, second paragraph, second line: For clarity change "overseas posts" to "the Joint Work Sites."
4. Page 4, next to last sentence: For emphasis in discussing the \$1 million in uncosted obligations, change "uncosted obligations" to "uncosted Fiscal Year 1998 obligations" and for clarity change "new vendor claims" to "unanticipated vendor claims."
5. Page 4, last sentence: For emphasis, change "uncosted funds" to "uncosted Fiscal Year 1998 funds." Also, since the previous discussions between DOE and GAO, we have used some of these Fiscal year 1998 funds for transition activities cited in the previous sentence of the report. To reflect this more current status, we suggest changing the word "most" to "much."

(141267)

Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. VISA and MasterCard credit cards are accepted, also. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:

**U.S. General Accounting Office
P.O. Box 37050
Washington, DC 20013**

or visit:

**Room 1100
700 4th St. NW (corner of 4th and G Sts. NW)
U.S. General Accounting Office
Washington, DC**

**Orders may also be placed by calling (202) 512-6000
or by using fax number (202) 512-6061, or TDD (202) 512-2537.**

Each day, GAO issues a list of newly available reports and testimony. To receive facsimile copies of the daily list or any list from the past 30 days, please call (202) 512-6000 using a touchtone phone. A recorded menu will provide information on how to obtain these lists.

For information on how to access GAO reports on the INTERNET, send an e-mail message with "info" in the body to:

info@www.gao.gov

or visit GAO's World Wide Web Home Page at:

<http://www.gao.gov>

**United States
General Accounting Office
Washington, D.C. 20548-0001**

**Bulk Rate
Postage & Fees Paid
GAO
Permit No. G100**

**Official Business
Penalty for Private Use \$300**

Address Correction Requested
