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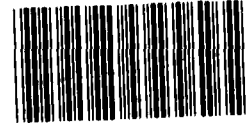
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January 3, 1984

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-213127



123180

The Honorable J. Erich Evered
Administrator, Energy Information
Administration

Dear Mr. Evered:

Subject: The Energy Information Administration Needs
To Strengthen Its Computer Systems
Development Procedures (GAO/RCED-84-42)

We have completed a review of the Energy Information Administration's (EIA's) procedures for developing automated information systems. We examined the application of EIA's procedures in the development of an automated hydropower billing system for the Federal Energy Regulatory Commission (FERC) and identified a number of system development procedural problems. We discussed our findings with EIA officials and, subsequently, EIA issued information systems development standards that addressed some of our concerns. However, we believe that the new standards could be further strengthened. These matters are summarized below and are detailed in enclosure I, which also includes a description of our review objective, scope, and methodology.

FERC initiated work to automate its hydropower billing system in March 1981. FERC requested EIA's assistance in this work since EIA regularly provides computer systems development services to FERC and other Department of Energy components. Following FERC's request, EIA awarded a contract, totaling about \$205,000, for the systems development work. EIA was responsible for providing guidance to the contractor in its systems development work.

We found that EIA did not have procedures for ensuring that systems development work was properly planned, reviewed, and tested. In this regard, EIA did not assure that the contractor's development work was based on a study of the needs of potential system users in conformance with federal procurement guidance. In addition, EIA did not adequately control changes to the system FERC requested after the original design had been agreed upon by FERC, EIA, and the contractor. Further, EIA did not have procedures to ensure that the completed automated system was tested and approved by FERC. These problems contributed to delays in developing the system and in awarding a subsequent contract in November

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1982, costing about \$149,000, to correct deficiencies identified in testing the initially developed system.

In January 1983 we discussed the results of our review with EIA officials and provided them with the results of our previous work involving principles and procedures for managing the development of automated systems. At that time, EIA had taken some steps to strengthen its systems development procedures and was continuing such efforts. In April 1983 EIA issued systems development standards that addressed several of the concerns we had expressed.

While we believe EIA's new procedures should help to alleviate many of the problems we identified, further improvements can be made. In this regard, we believe that EIA needs to require that a user-needs analysis be conducted as part of the systems development process. Because available funding may not be adequate for meeting the needs identified in this analysis, priorities should be established to ensure that the most critical needs are addressed.

Further, our review shows that EIA needs a procedure to strengthen its management reviews of the design and cost of new systems. While a management review is currently required to initiate EIA's systems development projects, subsequent reviews are performed by the systems analyst assigned to the project. We believe that management involvement at key decision points would provide management with a better basis for making decisions on whether to proceed with, alter, or terminate systems development projects.

RECOMMENDATIONS

To strengthen EIA's system development procedures, we recommend that you develop and implement specific procedures requiring that (1) a user-needs analysis be performed for systems development projects and (2) an appropriate management level, depending on the cost of the projects, conduct reviews when significant changes are made to the designs of the systems, at the end of each major development phase, and when planned costs or time frames are exceeded, or other significant problems are encountered.

AGENCY COMMENTS AND OUR EVALUATION

In commenting on this report (see enc. II), the EIA Administrator agreed with our first recommendation that user-needs analysis be performed for systems development projects. The Administrator said that EIA is revising its systems development standards to include a section on the performance of user-needs analysis.

In commenting on our second recommendation that specific procedures be developed and implemented for performing management

reviews, the Administrator recognized that such reviews are necessary for the successful completion of systems development projects and pointed out that management reviews are performed on all work products, including systems development projects, at the appropriate levels. For example, the Administrator said that top level management conducts semi-annual reviews on budget and annual operating plans. Also, lower level management conducts quarterly reviews on the status and progress of projects.

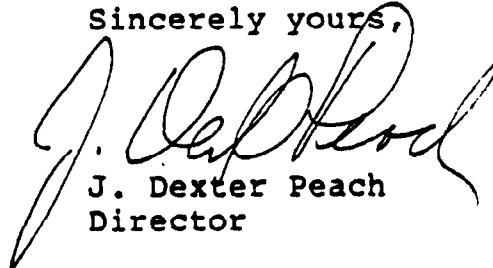
While the Administrator recognized that management reviews of systems development projects are appropriate, he did not agree that specific systems development procedures are needed to ensure that reviews are conducted. However, our review of the hydropower billing system shows that major design changes were made continuously throughout the development of the system by the contractor and, while the responsible EIA systems analyst coordinated the changes, they were not reviewed or approved by EIA management. Further, as stated in enclosure I, our previous reviews of federal systems development projects have shown that a specific procedure requiring management reviews of the projects is a basic requisite for providing appropriate management control over the projects.

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As you know, 31 U.S.C. §720 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 Secretary of Energy; the Chairman, Federal Energy Regulatory Commission; the four committees mentioned above; and to other interested parties. We will also make copies available to others upon request.

Sincerely yours,



J. Dexter Peach
Director

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ABBREVIATIONS

DOE	Department of Energy
EIA	Energy Information Administration
FERC	Federal Energy Regulatory Commission
GAO	General Accounting Office
GSA	General Services Administration
OMB	Office of Management and Budget

THE ENERGY INFORMATION ADMINISTRATION NEEDS TO
STRENGTHEN ITS COMPUTER SYSTEMS DEVELOPMENT PROCEDURES

BACKGROUND

The Energy Information Administration (EIA) regularly provides computer systems development services to various components within the Department of Energy (DOE), including the Federal Energy Regulatory Commission (FERC). These services include developing data collection programs, designing and programming computer systems, and acquiring computer hardware and software. For fiscal years 1981 through 1983, EIA estimated that it was appropriated \$24.4 million to provide such services to FERC.

In accordance with the Federal Power Act (16 U.S.C. 803), FERC annually bills about 700 public and private entities that are licensed to operate hydroelectric plants on federally controlled waterways. The bills include charges that licensed projects are assessed for using federal property and FERC's expenses incurred in administering the hydropower licensing program. To reduce the time and expense of preparing these bills, FERC initiated work in March 1981 to automate its billing system. To develop the computerized system, FERC requested EIA's assistance.

EIA awarded a contract for the systems development work and was responsible for providing guidance to, supervising, and coordinating the work of the contractor. The contract work initially cost about \$205,000, but the cost increased to nearly \$354,000 when it became necessary to correct the deficiencies in the initially developed system.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our overall objective was to assess the application of EIA's procedures in the development of an automated hydropower billing system for FERC. We reviewed the procedures used to guide EIA's systems development work and interviewed EIA and FERC officials to discuss the guidelines and procedures that were followed during the development of the hydropower billing system. We also reviewed planning documents that were prepared for the project, interviewed a contractor representative, and reviewed documentation prepared by the contractor and the correspondence and memorandums of meetings held among officials representing the contractor, EIA, and FERC. In addition, we reviewed documentation prepared by FERC to initiate work on the hydropower billing system.

In making our assessment, we used systems development criteria that are contained in our previous reports¹ that discuss (1) problems in developing automated systems, (2) lessons learned by federal agencies in designing, developing, and implementing management information systems, and (3) a framework for managing systems development. We also used criteria developed by the National Bureau of Standards to provide federal managers with guidance for determining the content and extent of documentation for automated systems.²

Our work was performed in accordance with generally accepted government auditing standards.

PROBLEMS IN EIA'S SYSTEMS DEVELOPMENT PROCEDURES

EIA did not have procedures for assuring that the systems development work for FERC's hydropower billing system was properly planned, reviewed, and tested. In this regard, EIA did not assure that the contractor's work was based on a study of the needs of potential system users as suggested in government procurement guidance provided by the Office of Management and Budget (OMB), the General Services Administration (GSA), and DOE. In addition, EIA did not adequately control systems design changes requested by FERC after the original design had been agreed upon by FERC, EIA, and the contractor. Further, EIA did not have procedures to ensure that the completed automated system was tested and approved by FERC. These problems contributed to delays in developing the system and in awarding a subsequent contract in November 1982, costing about \$149,000, to correct deficiencies identified in testing the initially developed system.

When FERC requested EIA's assistance in developing the hydro-power billing system in March 1981, it provided EIA a statement of its general requirements. These requirements called for the establishment of a data base, data entry support, and a system to calculate annual charges to hydropower licensees. Based on these requirements and discussions with FERC, the contractor that EIA hired to develop the system proposed a functional requirements

¹Lessons Learned About Acquiring Financial Management and Other Information Systems (GAO, Aug. 2, 1976), and Government-wide Guidelines and Management Assistance Center Needed To Improve ADP Systems Development (AFMD-81-20, Feb. 20, 1981).

²These guidelines are: FIPS Pub. 38, Guidelines for Documentation of Computer Programs and Automated Data Systems, Feb. 15, 1976, and FIPS Pub. 64, Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase, Aug. 1, 1979.

document. The purpose of this document was to describe the information that the system would produce, how it would operate, and the subsequent steps that would be needed to develop the system.

EIA's systems development procedures did not require that the contractor's work be based on a study of the needs of the potential system users. However, such a study is critical in developing an automated system because it provides a foundation for ensuring that the scope and contents of the system are adequately defined to produce understandable, timely, complete, and otherwise useful data. These studies are suggested for systems development projects by procurement guidance provided by GSA, OMB, and DOE.³

Despite government requirements, we found that user-needs studies were not required by EIA's systems development procedures. In developing the hydropower billing system, EIA limited its analysis of user needs to discussions with the system's potential users to gain a general understanding of the system and to estimate its cost. The FERC users were not asked, however, to specify their needs and priorities and did not participate in the system's design and development process. We also found that alternatives to meeting FERC's requirements were not adequately considered through an examination of the costs and benefits of meeting user needs.

Because a comprehensive study of the system's requirements was not prepared, the contractor did not have an adequate basis for planning the system to meet FERC's specific needs, and FERC requested numerous changes in the system as it was being developed. FERC's requests resulted in numerous systems design changes to enable the system to produce reports that were not specified as FERC requirements in the planning phase of the development project.

Our review also showed that EIA did not have procedures for reviewing, controlling, and documenting changes in the hydropower billing system and in testing the contractor's work. In this regard, after the needs of system users have been established, proposed changes to the development project should be thoroughly evaluated to determine whether they are critical to the effective operation of the system. Frequent changes make it difficult to complete the systems development work successfully because each development phase should build upon an earlier phase.

³GSA, Federal Property Management Regulations Admendment F-44 effective Jan. 15, 1981; OMB Circular A-109, Aug. 1976; and DOE Order 1330.1, Aug. 1, 1978.

We found that EIA did not adequately review and control systems design changes requested by FERC after the original design had been agreed upon by the contractor, FERC, and EIA. Our analysis shows that such design modifications were made continuously throughout the development of the hydropower billing system. FERC met with the contractor and EIA approximately 20 times to discuss changes in the system's requirements. Based on these discussions, the contractor agreed to make major changes related to data elements in the system, data included on FERC's billing form, and data that the system would generate.

Further, although the design changes were coordinated with the contractor by a systems analyst that EIA assigned to monitor the project, EIA's management did not approve or disapprove the changes. We were not able to document the effects of management not reviewing these changes. However, our previous reviews of such developmental projects have shown that agencies' management, at the appropriate management level, should be involved in monitoring such projects and should perform reviews at the end of each development phase and when the projects are not meeting their goals with regard to costs or time frames, or are encountering other significant problems.

In a February 1981 report⁴ on federal systems development projects, we identified management involvement during the development process as a primary factor in (1) providing appropriate control over systems design changes and costs and (2) avoiding problems similar to those EIA encountered in developing the hydropower billing system.

EIA's procedures did not require that systems development changes be documented. As a result, EIA was unable to ensure that the contractor understood the changes FERC had requested orally. From the available documentation on the development process, it was not possible for EIA to review the contractor's performance in making the changes and to determine whether FERC would accept the new design. For example, the contractor prepared six major systems documents and a validation report and discussed them with EIA and FERC during systems development progress reviews. We found that

--FERC did not document its comments on five of the seven products,

⁴Government-wide Guidelines and Management Assistance Center Needed To Improve ADP Systems Development (AFMD-81-20, Feb. 20, 1981).

--EIA did not notify the contractor in writing whether the products would be accepted, and

--there is no clear information on the disposition of either the written or oral comments that were made.

Although the contractor maintained minutes of the meetings that were held to discuss the system documents, the minutes did not provide information on how or whether each of the systems development issues and questions were resolved. Also, EIA did not provide the contractor any written notification that the system documents were satisfactory or in need of change.

We also found that EIA did not use systems development procedures to ensure that the system was fully tested and met FERC's needs. On January 18, 1982, the contractor told EIA that a variety of problems were identified during testing. An EIA official told us that the problems were minor or not included in the original requirements. On January 20, 1982, however, EIA received a memorandum from FERC which stated that, although FERC had not tested the final system received, it had tested the contractor's preliminary system and found that the (1) billing computations were not being performed as expected, (2) system's billing manuals needed improvement, and (3) production of hydropower bills with the automated system was more time consuming than the manual system.

In June 1982, after the final system had been tested and reviewed, FERC found that the system could not meet its data processing requirements and identified 28 potential deficiencies in the system. Subsequently, EIA, in November 1982, awarded a new contract for this work, increasing the cost by about \$149,000. The EIA Administrator said that development of the hydropower billing system was completed in August 1983 and FERC approved the system in September 1983.

ACTIONS TAKEN TO IMPROVE PROCEDURES

EIA has made progress in strengthening its systems development procedures. Since the hydropower billing system project was undertaken, EIA has adopted standards that address several of the concerns we discussed with EIA officials during our review. In April 1982 EIA adopted procedures that address the issue of assigning systems development responsibilities and the process through which contractor support is obtained and managed. However, we believe that EIA's procedures could be further strengthened in the areas of user-needs analysis and project management.

In January 1983 we discussed the results of our review with EIA officials and provided them with the results of our previous

work involving principles and procedures for managing the development of automated systems. As a result, in April 1983, EIA issued systems development standards that address several of the concerns we had. For example, the standards require the following systems development steps:

- The identification of the work flow of the proposed system, requirements for skills or software needed for the system, and documentation that must be developed for the system.
- The user's written approval of the work that has been performed at the conclusion of each major phase of development.
- Written approval of modifications to the system's design.
- The exposure of system users to all aspects of the system during the testing phase.
- Correction of system deficiencies based upon user's response to the systems test.

Although EIA has done much to improve its systems development procedures, it has not required that a user-needs analysis be performed for each project. The preparation of such an analysis for the hydropower billing system would have provided a basis for the system's subsequent design and helped to ensure that a complete and otherwise acceptable system was developed for FERC.

Further, our review shows that EIA needs a procedure to strengthen its management reviews of the design and cost of new systems. While a management review is currently required when a project is initiated, subsequent reviews are performed by the systems analyst assigned to the project. We believe that management involvement at key decision points would provide management with a better basis for making decisions on whether to proceed with, alter, or terminate systems development projects.

CONCLUSIONS AND RECOMMENDATIONS

In developing the hydropower billing system for FERC, EIA did not (1) adequately identify the needs of the system's users, (2) control and document changes to the system's design, and (3) ensure that FERC would accept the system before the system was accepted from the contractor. These procedural problems contributed to delays in system implementation and additional costs that were incurred to make the system acceptable for FERC's billing purposes.

EIA officials responsible for systems development projects agreed with our views on the need for improvements in this area, and EIA has directed that improved systems development procedures be adopted. We believe that the procedures EIA implemented should help to alleviate the causes of several of the problems we identified in our review. Nevertheless, we believe that additional improvements need to be made to ensure that newly developed systems are responsive to the needs of their users and that systems development projects are periodically reviewed by EIA management.

To strengthen EIA's systems development procedures, we recommend that the EIA Administrator develop and implement specific procedures requiring that (1) a user-needs analysis be performed for systems development projects and (2) an appropriate management level, depending on the cost of the projects, conduct reviews when significant changes are made to the designs of the systems, at the end of each major development phase, and when planned costs or time frames are exceeded, or other significant problems are encountered.

AGENCY COMMENTS AND OUR EVALUATION

In commenting on this report (see enc. II), the EIA Administrator said that the hydropower billing systems development work was completed in August 1983. The Administrator also said that the system and documentation were approved by FERC in September 1983.

The Administrator agreed with our first recommendation that user-needs analysis be performed for systems development projects. He said that this recommendation will be formally implemented through a revision of EIA's systems development standards to include a section on the performance of user-needs analysis.

In commenting on our second recommendation that specific procedures be developed and implemented for performing management reviews, the Administrator recognized that such reviews are necessary for the successful completion of systems development projects and pointed out that management reviews are performed on all work products, including systems development projects, at the appropriate levels. For example, the Administrator said that top level management conducts semi-annual reviews on budget and annual operating plans. Also, lower level management conducts quarterly reviews on the status and progress of projects.

While the Administrator recognized that management reviews of systems development projects are appropriate, he did not agree that specific systems development procedures are needed to ensure that reviews are conducted. However, our review of the hydropower

billing system shows that major design changes were made continuously throughout the development of the system by the contractor and, while the responsible EIA systems analyst coordinated the changes, they were not reviewed or approved by EIA management. Further, our previous reviews of federal systems development projects have shown that a specific procedure requiring management reviews of the projects is a basic requisite for providing appropriate management control over the projects.



Department of Energy
Washington, D.C. 20585

OCT 5 1983

Mr. F. Kevin Boland
Senior Associate Director
General Accounting Office
Washington, D.C. 20548

Dear Mr. Boland:

In response to your letter of September 15, 1983, on the draft General Accounting Office (GAO) report titled, "EIA Needs to Strengthen its Computer Systems Development Procedures," the Energy Information Administration (EIA) appreciates the opportunity to comment on this report.

Since our January 10, 1983, meeting on this subject, EIA has issued the following new standards:

- 82-4-01 Standard for Systems Development - April 12, 1983
- 82-4-02 Standard for Programming - April 12, 1983
- 82-6-05 Standard for Software Systems Documentation -
April 12, 1983
- 82-9-02 Standardized Codes, Abbreviations, and Acronyms -
March 29, 1983

The issuance of standards is an ongoing EIA effort to facilitate and improve management control of EIA development and production activities.

In addition to these EIA-initiated standards, your draft report recommends two further procedures. The first recommendation is that a user-needs analysis be performed for systems development projects. We concur with this recommendation and have instituted it as a regular procedure for systems development. Formal implementation of this recommendation can best be accomplished as a standard through the Functional Requirements Document in EIA Standard 82-6-05. We will take appropriate action to revise this standard.

The second recommendation is to require management reviews of the projects throughout the systems development process. EIA management review consists of the following: at the Administrator level, semiannual reviews are made on budgets and annual operating plans. Division-level reviews on project status and progress are held in the intervening quarters.

Coinciding with these reviews, the EIA Administrator also conducts semiannual reviews of each office's annual operating plan. Divisions are tasked with a fuel responsibility and division management reviews all issues regarding that fuel area, including data collection and processing, legislative and regulatory analyses, dissemination of information, forecasting, and systems development. Branches within the Divisions are tasked with either data services or analytical functions and include all areas of expertise within those fields. Branch chiefs provide review within those areas while team leaders provide the technical expertise necessary within a given discipline such as statistics, data processing, modeling and computer systems analysis. Reviews are held on all work products at the appropriate levels. When appropriate, higher management also conducts ad hoc project reviews at more frequent intervals, depending on the priority, scope, size, and status of the project.

With regard to the Federal Energy Regulatory Commission (FERC) projects, the Office of Program Management within FERC has initiated the procedure of reviewing each Data Services Request (DSR) forwarded to EIA for substance and detail. Further, the EIA sizing of all major FERC developmental efforts will include a Functional Requirements Document. The enhanced functional requirements standard will enable the FERC to ascertain whether continued EIA effort on systems development is cost-justifiable and a development priority.

A users seminar, required by the EIA Standard for Systems Development, is held to demonstrate how the system works and to discuss the adequacy of the documentation with the FERC users. This seminar will provide a formalized vehicle for EIA and FERC management to review projects.

On a more frequent basis, EIA has initiated monthly meetings on all major FERC projects to obtain user input and project scope. Additionally, EIA has instituted the procedure of requiring the FERC requesting office to sign-off on each DSR before project turnover.

Concerning the hydropower billing system on which the GAO report focused, the EIA development effort was completed on August 19, 1983. The annual bills were generated on July 22, 1983. Review of the system and documentation was approved by the FERC requesting official, Fred Springer, on September 26, 1983. (See enclosed DSR.)

GAO NOTE: The DSR enclosed in the Administrator's letter has not been included in this report.

We appreciate your comments and will continue to strive to produce the most relevant, cost-effective systems for EIA and their users.

Sincerely,



J. Erich Evered
Administrator
Energy Information Administration

Enclosure