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Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives

January 1988

AIR POLLUTION

EPA's Efforts to Develop a New Model for Regulating Utility Emissions

GAO/RCED-88-57

GAO

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Resources, Community, and
Economic Development Division

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The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

As you requested, we examined the Environmental Protection Agency's (EPA) responses to a number of issues you raised regarding its efforts to obtain an air quality model, the Advanced Utility Simulation Model (AUSM), and its policies for purchasing such computerized models. These and other issues were surfaced in your review of our report, Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models, (GAO/RCED-86-94, April 22, 1986). As agreed with your office, we will issue a separate report at a later date on EPA's answers to your questions about its efforts to reduce the uncertainties of air quality dispersion models.

In 1980, EPA began a project to develop the AUSM because the existing models were too inaccurate for regulatory purposes, too expensive to operate, and/or were unavailable for unrestricted use by anyone other than the model's developer. EPA plans to use the AUSM model to estimate the effects of alternative air pollution requirements on the electric utility industry and consumers, and for other purposes. After 4 years of development and expenditures of $3 million, under a cooperative agreement with the Universities Research Group on Energy (URGE), EPA received a model that could not be used as an analytical tool because of major technical problems in several key components. Subsequently, in August 1985, EPA awarded a contract to Science Applications International Corporation (SAIC) to complete and test the AUSM. Because of concerns about increased costs and delays in the development of the AUSM, you asked EPA a series of questions and asked us to evaluate EPA's reply.

The four issues you asked EPA to address regarding its procurement of the AUSM model are (1) when and how the AUSM will be completed and made fully operational; (2) why EPA originally used a cooperative agreement rather than a procurement contract, as the Federal Grant and Cooperative Agreement Act appeared to require in this case; (3) why EPA did not require delivery of an operational model under the cooperative agreement and whether EPA has any recourse, given the contractor's

failure to deliver; and (4) whether EPA's contracts for computer models ensure that the models have no proprietary restrictions and that they include an enforceable obligation to deliver what EPA contracted for.

In summary, we found the following:

- EPA estimates that development of the AUSM will be completed by the end of fiscal year 1989 and that its total costs will be about $5.2 million. EPA currently has a version of the model available for use, but it will require modification, testing, and evaluation before it is fully operational. On the basis of EPA's progress to date, its estimates for completing the model's development appear accurate.
- EPA said it used a cooperative agreement with URGE because the purpose of the project was to support and stimulate the development of a model that would be of use not only to EPA, but also to states, local governments, and industry. According to EPA, it was reasonable under the Federal Grant and Cooperative Agreement Act to carry out the project through a cooperative agreement because of the broad national use of the model. Nevertheless, we believe that given EPA's intent to use the model for its own purposes, it would have been more appropriate to use a procurement contract that specified terms of delivery.
- EPA did not directly address the question of why delivery of an operational model was not required. However, it does acknowledge in retrospect that the arrangement it had under its cooperative agreement was not well suited for obtaining such a model. Our review of the cooperative agreement indicates that EPA had no recourse against URGE for nondelivery because delivery was not specified in the contract.
- EPA did not respond to your fourth question. However, our review of EPA's arrangements for obtaining computer models determined that the (1) 9 cases where contracts were used had enforceable delivery clauses, and clauses precluding proprietary restrictions; and (2) 4 cases where interagency agreements were used instead of contracts did not require delivery of a model,[1] and potential proprietary problems have been experienced in one of these cases.

On the basis of these findings, we are recommending that the Administrator, EPA, complete guidelines on the use of procurement contracts, cooperative agreements, and interagency agreements, and publish them as expeditiously as possible.

[1]Whereas cooperative agreements are used between federal and nonfederal activities, interagency agreements are used to contract between federal agencies. For the purposes of this report, they are similar in that neither specifies the terms of delivery for a computer model such as AUSM, while a procurement contract normally specifies such terms.

The responses to each of your questions are further discussed in this letter and explained in detail in the appendixes.

Completion of the Model

EPA's response to your letter indicated that the AUSM's components had been fully integrated into a working model and that results were being produced for test purposes. EPA noted that the results were being analyzed to detect and correct programming and logic errors, and after several months of testing, a reliable operational model would be available in 1986, and an improved version with expanded capabilities would be available during 1987. The response did not, however, indicate a final completion date. EPA further responded that the model will be produced for $1.5 million, the amount budgeted for the completion of the model delivered by URGE. However, annual maintenance costs of several hundred thousand dollars will be needed to keep data bases current afterward.

Although it did not provide a final completion date as requested, EPA's prognosis for future progress appears reasonable. Since EPA's response, SAIC has delivered four versions of the AUSM, with several more versions planned for delivery through fiscal year 1988. The model's test results have been generally favorable, and evaluations of the model by outside organizations have thus far detected only minor problems. The estimated cost to complete the development and testing of the model is $500,000 over the original budgeted amount of $1.5 million, according to EPA's most recent estimates. A final product, tested and evaluated, is due to be delivered in September 1988. EPA currently estimates annual maintenance costs after model completion at about $300,000 per year, a more specific amount than it provided earlier.

Use of Cooperative Agreements Versus Procurement Contracts

The Federal Grant and Cooperative Agreement Act requires the use of procurement contracts when the principal purpose of the relationship between the federal agency and recipient is to purchase property or services for the direct benefit or use of the federal government. The act specifies that a cooperative agreement should be used when

"the principal purpose of the relationship is the transfer of money, property, services, or anything of value to the State or local government or other recipient to accomplish a public purpose of support or stimulation authorized by Federal statute, rather than acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government."

In its response, EPA maintained that because it intended that the model be helpful to states, local governments, and industry as well as EPA, such "broad national use" justified use of a cooperative agreement. It noted that, by contrast, a procurement contract should be used when the principal purpose of a relationship is the acquisition of goods or services. We believe, however, that in this situation, a contract would have been a more effective instrument because it could have permitted EPA to require delivery of a model.

EPA noted that to avoid confusion under similar circumstances in the future, the agency would issue additional guidance by late 1986 that would (1) clarify the type of legal instrument to be used for projects involving computer models and (2) specify that a procurement contract is to be used if the principal purpose of a project is to obtain a computer model for EPA's direct benefit and use.

However, EPA has not met this timetable for revising its guidelines. As of October 1987, EPA had still not completed and published its guidelines in its Assistance Administration Manual, as it intended. The Chief of EPA's Grants Policy and Procedures Branch attributes the delay to the retirement of the employee responsible for processing the revision. He indicated that although the revision is substantially complete, he could not establish a timetable for its issuance.

Why Delivery Was Not Required and Why Recourse Is Not Available

EPA's response did not directly address the agency's rationale for not requiring delivery of an operational model in its cooperative agreement. Rather, it explained its rationale for organizing the effort in a "decentralized manner" through the agreement as the best way to develop creative new approaches to modeling of the utility industry. EPA acknowledged, in retrospect, that its approach was not well suited for actually developing an efficient operational model, and in the future, delivery of such a model would probably be specified in a procurement contract. EPA's response did not address what recourse the agency may have against the contractor for not delivering an operational model. However, our review of the cooperative agreement showed that it only required the contractor to do its best to adhere to the terms of the agreement. Since it did not specifically require the contractor to provide an operational model, EPA had no legal recourse in the event of its nondelivery.

EPA's Contractual Requirements in Procurements of Computer Models

EPA did not respond to your request to examine all model development contracts for computer models to ensure that (1) the models will be fully available to EPA with no proprietary restrictions and (2) the contracts include enforceable obligations to provide the delivery for which EPA contracted. According to EPA officials, this question was overlooked in the September 19, 1986, reply.

In response to this question, we conducted our own review of EPA's current contracts and interagency agreements for model development. Our review disclosed that (1) where contracts were used, all had enforceable delivery clauses and clauses precluding proprietary restrictions and (2) in the four cases where interagency agreements were used instead of contracts, none require such delivery. Although proprietary products are generally not an issue in interagency agreements, the development of one model has presented a potential problem involving proprietary data.

Conclusions

EPA and its contractor appear to be making progress in developing the AUSM, and a fully operational model that has been tested and evaluated is scheduled for delivery in September 1988. To avert the types of problems that characterized this project during its earlier years, EPA had planned to publish proposed changes to its Assistance Administration Manual to instruct its officials on the appropriate use of contracts, cooperative agreements, and interagency agreements. However, these efforts have thus far experienced substantial delay. Given the problems EPA experienced in procuring the AUSM model, and the substantially greater success that the agency has had in obtaining operational models through procurement contracts, we believe that such a revision would improve EPA's process for procuring operational models.

Recommendation

Therefore, we recommend that the Administrator, EPA, designate an appropriate official to complete the guidelines on use of contracts, cooperative agreements, and interagency agreements, and that these guidelines be published expeditiously. We also recommend that the revision clearly articulate that a procurement contract is to be used when delivery of an operational model is expected.

Scope and Methodology

To obtain information for this report, we reviewed documentation and interviewed EPA and contractor officials. We reviewed the actions taken by EPA and SAIC on the development of the AUSM since EPA's reply. We

have discussed the information contained in this report with EPA officials and have included their comments where appropriate. However, as you requested, we did not obtain official agency comments on a draft of this report. We conducted our review between April 1987 and October 1987. This review was conducted in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly release its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time copies of the report will be sent to appropriate congressional committees, the Administrator, EPA, and the Director, Office of Management and Budget.

This work was performed under the general direction of Hugh J. Wessinger, Senior Associate Director. Other major contributors are listed in appendix VI.

Sincerely yours,

J. Dexter Peach

J. Dexter Peach
Assistant Comptroller General

Contents

Abbreviations

AUSM	Advanced Utility Simulation Model
CEUM	Coal and Electric Utility Model
EPA	Environmental Protection Agency
GAO	General Accounting Office
M.I.T.	Massachusetts Institute of Technology
NCAR	National Center for Atmospheric Research
RADM	Regional Acid Deposition Model
RCED	Resources, Community, and Economic Development Division
SAIC	Science Applications International Corporation
URGE	Universities Research Group on Energy

Introduction

Mathematical computer models play an important role in the efforts of the Environmental Protection Agency (EPA), states and local governments, and industry to reduce air pollution. EPA uses one category of models, utility-sector least-cost optimization models, to predict the effects of alternative air pollution reduction methods on (1) cost to the electric utility industry, (2) pollution levels, and (3) consumer costs in different regions of the country.

On April 22, 1986, we issued Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models.[1] This report, among other things, summarized the problems EPA had experienced in developing a new utility-sector least-cost optimization model, the Advanced Utility Simulation Model (AUSM). Briefly, the report noted that, in September 1980, EPA entered a cooperative agreement with the University of Illinois to develop the AUSM.[2] The University of Illinois and its subcontractors were collectively known as the Universities Research Group on Energy (URGE). Each member of URGE was responsible for developing different modules (sections), e.g., a state-level module, of the model. In total, seven modules were to be developed to make up the AUSM model. The project was scheduled for completion in October 1983 at an approximate cost of $3.6 million. On November 30, 1984, URGE delivered an unfinished model to EPA. Therefore, on August 21, 1985, EPA awarded a 3-year, $1.5 million procurement contract to Science Applications International Corporation (SAIC) in McLean, Virginia, to complete and test the AUSM model.

On June 9, 1986, the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives, sent our report to EPA with a number of questions on EPA's modeling program. The Chairman requested that EPA send a copy of its reply to us for our review and comment. This report provides our comments on EPA's reply of September 19, 1986, dealing with questions on the development of the AUSM and its general procurement policies regarding computerized models. As requested, a separate report will be issued at a later date on the additional questions dealing with ranges of uncertainties of air quality models.

[1]GAO/RCED-86-94.

[2]A cooperative agreement is a legal instrument used for providing federal assistance to a state or local government, or other recipient. Cooperative agreements are used to secure goods or services that are not principally for the direct benefit or use of the government and do not usually require the delivery of a product, only that the organization granted the cooperative agreement does its best to deliver a product.

Objectives, Scope, and Methodology

As agreed with the office of the Chairman, we examined EPA's responses to the following questions:

- Explain when and how the AUSM model will be completed and fully operational, and whether it will cost more than the additional $1.5 million.
- Explain why EPA failed to comply with the Federal Grant and Cooperative Agreement Act of 1977 in the AUSM procurement.
- Explain why a product was not required from URGE under the cooperative agreement. Also, examine the AUSM procurement thoroughly to determine if EPA has any recourse against URGE.
- Examine all contracts, etc., regarding computer models to ensure that (1) the model procured will be fully available to EPA without restrictions and (2) the contract includes an enforceable obligation to deliver what EPA contracted for.

To review documentation and interview officials on the development of the AUSM, we visited EPA headquarters and the EPA AUSM Project Officer. We also visited SAIC, the contractor that took over the development of the AUSM project.

We discussed the problems encountered in developing the AUSM model with the EPA Project Officer and SAIC. We also reviewed key documents, including status reports prepared by EPA and the developer. We reviewed the actions taken by EPA and SAIC on the development of the AUSM model since EPA's response.

For the two questions to which EPA did not respond—to determine if EPA has any recourse against URGE and to examine contracts to ensure that they include enforceable obligations to deliver unrestricted models—we obtained and reviewed documentation to enable us to address these questions.

Our review was conducted between April 1987 and October 1987. We discussed factual information with EPA program officials and have included their comments where appropriate. However, in accordance with the requester's wishes, we did not ask for official agency comments on a draft of this report. This review was conducted in accordance with generally accepted government auditing standards.

Current Status of the Advanced Utility Simulation Model

EPA reports that the AUSM was completed in May 1986 and, after further testing, was operational as of September 1987. However, EPA will continue to modify and evaluate the model, using contractors, through the end of fiscal year 1988, when it expects to have a fully operational, tested model. The estimated cost to complete the development and testing of the model is $1,986,674, which is $486,674 over the $1.5 million originally budgeted. In addition, EPA plans to spend about $300,000 annually to maintain and update its data bases.

Background

As originally planned, the project to develop AUSM was scheduled for completion in October 1983, at an approximate cost of $3.6 million, with about $3.4 million from EPA and the rest from URGE. However, URGE did not deliver a fully operational model because it encountered major technical problems. On November 30, 1984, 1 year later than planned, URGE delivered a model to EPA that could not be used as an analytical tool because of problems in three of its seven modules. EPA paid URGE about $3 million for this model.

After delivery of the model, EPA project officers for the AUSM decided that it would be in the agency's best interest to terminate funding the cooperative agreement because it was getting diminishing results from URGE. Therefore, on August 21, 1985, EPA competitively awarded a contract to SAIC to complete and test the AUSM. The estimated cost for this contract, including the first year and 2 option years on the contract, is approximately $1.5 million. After the model was completed and tested, EPA planned to have outside organizations examine the model to provide an independent evaluation of its merits.

Subcommittee's Question

Explain when and how the AUSM will be completed and made fully operational, and whether it will cost more than the additional $1.5 million.

EPA's Reply

EPA explained when and how the AUSM will be completed and made fully operational, and whether it will cost more than $1.5 million as follows:

"The remaining program code needed to complete the (AUSM) components of the Advanced Utility Simulation Model was recently completed (May 1986) and the fully integrated model is now producing results for test purposes. These initial AUSM model run results are currently being carefully analyzed to detect and correct

programming and logic errors. This 'debugging' process is costly, as it must be meticulously done, but it is necessary in order to develop a model capable of producing reliable results. It is expected that this effort of testing the AUSM will continue for several months resulting in an operational, reliable version of the AUSM model this year and a second, operational version with expanded capabilities next year.

"Now that the AUSM components have been fully integrated into a working model and the model is producing outputs, we are confident that an operational model can be produced for the budgeted amount. However, the AUSM will have a year-to-year maintenance cost since several data bases upon which the model relies require periodic updating. These data bases include specific information on units in operation or recently placed in operation, unit construction and retirement plans, utility company financial factors, and changes in state economic regulation. Maintenance resources of several hundred thousand dollars per year will be needed after the expiration of the current $1.5 million contract to keep data bases current.

"We support your view that models should be as reliable as we can make them to fairly assess regulatory impacts. Since the magnitude of expenditures that potentially could be required of the electric utility industry under a regulatory program is large (i.e., in the billions of dollars), we feel it is appropriate to expend the $1.5 million budgeted for the AUSM model and to support its maintenance requirements in future years to ensure that regulatory decisions are made with a quality estimate of the effect of regulations on utility company finances, consumer electric rate schedules, and pollutant reductions.

". . . We are confident that our current efforts on the AUSM model will produce in the near future a fully operational model which is acceptable to EPA and brings in the creative new concepts from the research effort."

GAO's Evaluation and Additional Information

Although it did not provide a final completion date, as requested, EPA's prognosis for future progress appears reasonable. The AUSM components have now been fully integrated into an operational model available for use. Since EPA's response additional progress has been made, additional work planned on the model, and a revised timetable established for the completion of the AUSM model.

Since the AUSM is now fully integrated into a working model, SAIC has turned its attention to detecting and correcting programming and logic errors. According to EPA's project officer, as these corrections are made, SAIC delivers a revised version of the model to EPA, which includes refinements and improvements over the previously delivered versions. According to EPA's project officer, this review and improvement process will lead to a fully tested operational model by the end of September 1988.

As of September 1987, EPA had paid $4.1 million for the development of the AUSM. The estimated total cost of the AUSM is $4.9 million. One year remains on the contract with SAIC, which EPA expects will be primarily devoted to testing the entire AUSM.

Current Status of the AUSM

SAIC has delivered four versions of the AUSM to EPA, and each new version has been modified and improved over the previous version. Four additional versions of the model are planned for delivery between December 1987, and the end of fiscal year 1989. These versions will incorporate recommendations from the AUSM evaluations, update the AUSM's data base year to 1985, and improve the AUSM's data bases. The versions delivered are:

- Version 1.0, delivered in June 1986, was the first version of the AUSM that was functional for all states and regions of the United States.
- Version 1.1, delivered in August 1986, was the same as Version 1.0, with the addition of an updated unit inventory data base.
- Version 1.2, delivered in April 1987, includes revisions to the dispatch and plan modules. It is the version of the AUSM that EPA expects to have usable emissions outputs.
- Version 2.0, delivered in August 1987, is the first fully operational version of the model.

AUSM Results to Date Are Favorable

During its test phase, the AUSM has been tested against the only other available least-cost optimization model devoted to the electric utility industry, the Coal and Electric Utility Model (CEUM). Different scenarios were tested and the predictions of the two models were compared. Test results showed that the two models predicted within 1, 2, and 9 percent of each other on the three scenarios tested. A separate comparison of the two models showed that AUSM and CEUM predictions of the 1990 sulfur dioxide emissions were within 150,000 tons of each other, less than 1 percent difference, with CEUM predicting higher emissions.

In addition, the AUSM's estimates of 1980 emissions data were compared with historical 1980 emissions data to determine the accuracy of the model's predictions. The test results showed that the AUSM has been able to predict emissions output that are within 3 percent of the national historical emissions data. In state-to-state comparisons, the AUSM predicted emissions within 5 percent for all states except two, where the predictions were within 15 percent. Since the tests were completed, EPA's project officer said EPA and SAIC have modified the AUSM to bring the state-

to-state emission predictions closer to the actual and have lowered the percent differences between the actual emissions and the predictions. These tests have been designed to detect one area of the model's reliability—confidence in the model's ability to predict emissions.

Reviews of AUSM by Outside Organizations

While EPA and SAIC are continuing to develop, test, and improve the AUSM, the Interagency Task Force on Acid Precipitation and the Massachusetts Institute of Technology (M.I.T.) have begun the evaluation phase by reviewing the methodology of the model and its major components to identify potential issues, strengths, and weaknesses. The first evaluation of the model's methodology was done after the completion of the state-level module of the AUSM. The Electric Power Research Institute directed M.I.T. to evaluate the state-level module. The evaluation was paid for by the Institute. M.I.T. found a number of minor problems with the state-level model. SAIC corrected the identified problems and revised the state-level module. This modification resulted in Version 2.0 of the AUSM, delivered in August 1987. Version 2.0 has revised finance and demand modules, including revised cost data in the pollution control module. It is the first version EPA expects to produce usable financial data. M.I.T. also recommended that EPA should extensively test the model as an integrated whole.

In addition to the M.I.T. review, the Interagency Task Force on Acid Precipitation conducted a peer review of the AUSM model in September 1985. The peer review panel recommended that the AUSM should be tested. This recommendation led to the M.I.T. testing.

EPA's Plans for Completion of AUSM

According to EPA's AUSM project officer, Version 2.0, delivered in August 1987, gave EPA a fully operational AUSM model. During fiscal year 1988, EPA plans to extensively test the AUSM and rely on outside, independent evaluations to verify its merits. The independent evaluations are intended to provide the peer review necessary to improve the credibility and acceptability of the model by the technical community.

On September 23, 1986, EPA awarded a $50,000 cooperative agreement to M.I.T. to evaluate a portion of the model that will be used to analyze coal markets in response to utility coal demand. The evaluation focuses on the major components of the model, such as the coal supply module, and the methodology of the model, identifying the strengths and weaknesses of the methodology. According to the EPA project officer, the cooperative agreement, as modified, costs $100,000. The review is

scheduled for completion in December 1987. EPA plans to direct SAIC to incorporate all pertinent M.I.T. recommendations into the AUSM by December 1987. After the modification is complete, SAIC is scheduled to deliver Version 2.1 of the AUSM model to EPA. This version was originally scheduled for October 1987; however, according to EPA's project officer, M.I.T. is taking longer than anticipated; therefore, the completion date was changed to December 1987.

EPA also expects Version 2.2 of the AUSM to be delivered in December 1987. Version 2.2 will be enhanced by including new financial and pollution control modules and will be improved by modifications resulting from testing and debugging of the integrated AUSM.

According to EPA's project officer, the Electric Power Research Institute plans to fund the final evaluation of the AUSM. The Institute is concerned that the AUSM will be used in the future to require electric utilities to add to or modify pollution control equipment on existing facilities or on planned new facilities. The Institute plans to use M.I.T. for the evaluation and will direct M.I.T. to review the entire AUSM to verify to its satisfaction that the model is as accurate as possible prior to its use. EPA's AUSM project officer told us EPA will fund the audit if the Institute does not carry out its plans. The audit is scheduled for completion in December 1988.

Future Modifications of AUSM Planned

At the end of September 1988, EPA's project officer said EPA plans to have a fully tested operational AUSM. As currently planned, this model and complete documentation will be delivered for about $4.9 million. Table II.1 shows how costs and responsibilities for this model were divided among several organizations.

Table II.1: Costs of and Responsibilities for Completing the AUSM

Organization and Responsibility	Cost
URGE	
initial development	$3,199,317
SAIC	
model completion	1,536,674
M.I.T.	
review of model's methodology	100,000
ICF	
comparison runs of AUSM and CEUM	70,000
Total	**$4,905,991**

After the fully tested operational model is delivered, EPA will make some additional revisions. According to EPA's project officer, it has become apparent that the original design of the AUSM and its data bases cannot adequately address the two areas that will be key to the debate on strategies for controlling acid deposition. These areas are

- the impact of extending the life of existing coal-fired utility generating units rather then building new units; and
- the cost and availability of low-sulfur coal in the eastern United States.

EPA's project officer estimates that the work to incorporate these areas into the model will be completed in fiscal year 1989, and EPA will then have Version 3.0. Version 3.0 should allow EPA to more accurately simulate the effects of extending the life of existing coal-fired generating plants and the utilization of low-sulfur coal in the east. These changes should improve the analysis of strategies to control acid deposition.

As currently developed, the AUSM uses 1980 as the base year to predict future emissions. According to EPA's project officer, EPA also plans to update the base year to 1985 during fiscal year 1989. This updating will include the financial condition of electric utility companies in 1985 and the additional electric generating units announced since 1980. The updated model will be Version 4.0. To complete Versions 3.0 and 4.0 in fiscal year 1989, EPA has a preliminary fiscal year 1989 budget of $280,000.

AUSM Maintenance Planned After Modifications Are Complete

After the AUSM's modifications are complete, EPA will still incur costs to maintain its data bases. In its September 19, 1986, reply, EPA stated that the AUSM will have a year-to-year maintenance cost since several data bases upon which it relies require periodic updating. These data bases include specific information on electric generating units in operations, unit construction and retirement plans, utility company financial factors, and changes in state economic regulations.

EPA's project officer currently estimates that it will cost about $300,000 annually for the maintenance effort. EPA has programmed $300,000 for these efforts in fiscal year 1990, the first year of maintenance. EPA's AUSM project officer currently plans to issue a request for proposal for a competitive contract for the updating and maintenance of the AUSM sometime in late fiscal year 1988.

Detailed Guidelines for Implementing the Requirements of the Federal Grant and Cooperative Agreement Act of 1977 Have Not Been Published

EPA states that it decided upon a cooperative agreement with URGE rather than a procurement contract because its principal purpose in that project was to encourage the development of a model that would be useful to state and local governments, and industry, as well as to EPA. According to EPA, the Federal Grant and Cooperative Agreement Act distinguishes between procurement contracts, whose purpose is to obtain a good or service for a federal agency's direct benefit and use, and a cooperative agreement, whose purpose is to "carry out a public purpose of support."

Nonetheless, EPA agreed with our April 1986 recommendation to issue clarifying guidelines on when it is appropriate to use procurement contracts and cooperative agreements. As of October 1987, these guidelines have not been published, and EPA cannot predict when they will be available.

Background

In our April 1986 report, we pointed out that the Federal Grant and Cooperative Agreement Act of 1977 specifies that a procurement contract is the correct legal instrument whenever the principal purpose is the acquisition of property or services for the direct benefit of the federal government. In the initial development of the AUSM model, EPA used a cooperative agreement as the legal instrument with URGE. Since URGE did not deliver a fully operational model, EPA awarded a contract to SAIC for the completion of the AUSM.

Subcommittee's Question

Explain why EPA failed to comply with the Federal Grant and Cooperative Agreement Act of 1977 in regard to the AUSM procurement.

EPA's Reply

EPA answered as follows:

"... You questioned whether EPA complied with the Federal Grant and Cooperative Agreement Act of 1977, 31 U.S.C. §§ 6301 et seq., in funding the project through a cooperative agreement as opposed to a procurement contract. ...

"... the Federal Grant and Cooperative Agreement Act requires the use of procurement contracts where the principal purpose of the relationship between a Federal agency and recipient is to purchase property or services for the direct benefit or use of the Federal Government. For cases in which the principal purpose of the relationship is to transfer money or an item of value to the recipient to carry out a public

purpose of support authorized by a law of the United States, a grant or cooperative agreement is the appropriate instrument.

"EPA procedures to ensure that extramural funding decisions comply with the Act's requirements are set forth in EPA Order 1000.19, which was published in the Federal Register on October 30, 1979, ... The Grants Administration Division of the Office of Administration and Resources Management has recently drafted a proposed addition to the Assistance Administration Manual (number 5700) that will provide more detailed guidelines for implementing the requirements of the Federal Grant and Cooperative Agreement Act. The revision should be published in late 1986, at which time it will supersede EPA Order 1000.19. Among other things, the revision will clarify the type of legal instrument necessary for research projects, including projects involving computer models. It will note that a procurement contract must be used if the principal purpose of a project is to obtain a computer model for EPA's direct benefit and use.

"In the case of the AUSM project, the primary purpose of the project was to support and stimulate the University of Illinois and other participants to develop a model that could be helpful not only to EPA, but also to State, local government, and industry efforts to reduce air pollution. Given the intended broad national use of the model's concepts, it was reasonable for EPA under the Federal Grant and Cooperative Agreement Act to carry out the project through a cooperative agreement. In fact, several states or regional organizations have already benefitted considerably from this project. These government agencies have obtained models for their own use from participants in the URGE project. These models are derived from the work done by the URGE researchers under their cooperative agreement with EPA. This is, of course, entirely consistent with the requirements of the Federal Grant and Cooperative Agreement Act."

GAO's Evaluation and Additional Information

Although EPA explained that some benefits were derived by using a cooperative agreement for developing the AUSM, it agreed with our April 1986 recommendation to issue guidelines clarifying when a contract or an agreement for cooperation should be used for developing a model.

EPA Order 1000.19, issued on September 18, 1979, includes EPA's Policies and Procedures for implementing the Federal Grant and Cooperative Agreement Act of 1977. The order states that procurement contracts will be used to enter into acquisition relationships or whenever the directors of the Grants Administration Division and Procurement and Contracts Management Division jointly determine that the use of a type of procurement contract is otherwise appropriate. However, since the order has not been made a part of the Assistance Administration Manual, an EPA official commented that more detailed guidelines were needed for implementing the requirements of the Federal Grant and Cooperative Agreement Act.

In its reply, EPA promised that more detailed guidelines would be implemented with a proposed addition to the Assistance Administration Manual that should be published by late 1986. According to EPA, this proposed revision will require that a procurement contract be used if the principal purpose of a project is to obtain a computer model for EPA's direct benefit and use.

As of October 1987, however, EPA had not completed and published the revision to the Assistance Administration Manual. The Chief, Grants Policy and Procedures Branch of the Grants Administration Division of EPA's Office of Administration and Resources Management, told us that the employee responsible for processing the revision retired, and EPA has not replaced him. In the meantime, the Chief of the Grants Policy and Procedures Branch said he had worked part-time on the revision. The revision has been sent out for comments, and comments have been received and incorporated where warranted. However, the revision has not been sent forward to EPA management for approval. The Chief said he could not establish a timetable for the completion of the revision.

Why Delivery of the Model Was Not Required and Why Recourse Is Not Available to EPA

EPA does not directly explain why it did not require the delivery of an operational model under its cooperative agreement with URGE. In retrospect, EPA does recognize that the cooperative agreement was not an appropriate means for obtaining an operational model. Our review of the cooperative agreement indicates that EPA has no recourse for compelling delivering of an operational model since it was not specifically required in the agreement.

Background

In our April 1986 report, we pointed out that URGE delivered an unfinished model that could not be used as an analytical tool because of problems in 3 of its 7 modules: one module was unfinished; one lacked a great deal of necessary data; and one was not properly organized. We also pointed out that EPA project officers decided that it would be in the agency's best interest to terminate funding the project because it was getting diminishing returns from URGE. Therefore, EPA awarded a competitive contract to SAIC to complete and test the AUSM model.

Subcommittee's Question

Explain why a product was not required from URGE under the cooperative agreement and why EPA has no recourse against URGE.

EPA's Reply

EPA explained why it did not require a product from URGE and why it has no recourse against URGE to compel it to deliver an operational model as follows:

"EPA agrees that the AUSM development process has experienced problems and has not yet achieved the desired results. However, we do not believe those problems were caused by EPA's use of a cooperative agreement as the funding mechanism. The university based project funded under the cooperative agreement was conceived as a research effort which was expected to produce computer model concepts with broad national use.

"The AUSM project was initially conceived as a way of stimulating national experts in utility economics and engineering to develop creative new approaches to modeling of the utility industry. In keeping with this goal, the project was organized in a fairly decentralized manner with each of the several senior researchers (at different universities) given a great deal of autonomy. Overall coordination was achieved by consensus of the research team. In addition, EPA believed that the universities' work would be made available generally and be of broad benefit to states, local governments and utilities in their efforts to address air pollution problems. EPA realized

that it would be necessary to transfer the project results to an EPA support contractor to be operated and modified as necessary to support EPA policy and regulatory analyses.

"It seems that the loosely organized university-based project was well designed to develop new concepts for model development. It does not appear that this arrangement was well suited for actually developing an efficient operational model. Based on our experience with the AUSM project, I believe that EPA would again use a "committee" of national experts to develop the analytic concepts for the model. We would undoubtedly shift to a more production oriented management structure for the actual coding and testing of the model. If the objective was a model primarily for EPA's direct use, we would use a procurement contract.

"In the case of the Universities Research Group on Energy, the researchers acknowledged that the model which was transferred had problems and limitations, but that statement could be made about any complex computer model ever developed. It is always a matter of judgement to determine when model development is complete and when a model is ready for normal use. It is not true that "nothing of real value" was produced by the URGE project. The project produced a new model structure for analysis of the electric utility industry, a great deal of very detailed documentation, and an operational model code which has been transferred to several different computer systems and users. These are significant achievements. There were obviously components of the model system which did not operate to the satisfaction of the EPA Project Officer and his support contractors at the time of transfer. To make the model usable by EPA policy offices, the EPA Project Officer and his ORD management decided to terminate the university based project and to initiate a contractual effort. I believe that was a correct decision.

"EPA's Office of Research and Development will take into account the experiences from this project in planning and designing its future model development activities. In addition, I believe that we have taken the appropriate action to take advantage of the creative new aspects in utility sector modeling from the URGE project. We are now moving the model forward to a condition that EPA can accept as fully operational in the near future . . . . In summary, the problems with the AUSM development cannot be addressed simply by focusing on the funding mechanisms."

GAO's Evaluation and Additional Information

EPA's reply generally describes what the URGE project delivered and the direction that EPA chose to complete the AUSM. SAIC advised us that it had been able to use some of the modules delivered by URGE by modifying them; while other modules had to be completely scrapped. EPA's reply does not, however, address what recourse EPA may have against URGE for the failure to deliver an operational model.

The cooperative agreement with URGE did not require the delivery of an operational model, only that URGE do its best to adhere to the terms of the agreement. Only by specifying in the procurement instrument that

delivery of an operational model was required, could EPA have required an operational model to be delivered. Since URGE was not required to deliver an operational model, EPA does not have any recourse against URGE for nondelivery of an operational model.

EPA's Contracts and Interagency Agreements for Model Development

EPA did not respond to the Chairman's question on whether contracts to develop computer models require that the model be fully available to the agency, and whether such contracts include an enforceable obligation to provide the delivery of the product for which the agency contracted. Further, EPA told us that it has no current plans to conduct such a review of its contracts, cooperative agreements, and interagency agreements. Our review of EPA's current procurement contracts found that all required delivery of an operational model without any restrictions. However, none of the interagency agreements did so. In the case of one model being developed under an interagency agreement, the Regional Acid Deposition Model (RADM), there are also potential problems concerning proprietary data.

Background

In our April 1986 report, we pointed out that limitations of the currently used utility-sector least-cost optimization models had led EPA to decide to develop the AUSM. The CEUM was the most widely used utility-sector least-cost optimization model. We also pointed out the CEUM has limitations because it is owned and controlled by its developer, ICF, Inc., which does not allow the CEUM to be released outside the company. The proprietary nature of the CEUM limits the modeling information that EPA can share with the industry being regulated, environmental groups, and other researchers. In addition, we pointed out that the cooperative agreement EPA used for the development of the AUSM required URGE to make its best effort to adhere to the terms of the agreement.

Subcommittee's Question

In his June 1986 letter to EPA, the Chairman asked if all computer model development contracts require that (1) the model is fully available to EPA with no restrictions and (2) include an enforceable obligation to provide the delivery for which EPA contracted.

EPA's Reply

In its September 19, 1986, reply to the Subcommittee, EPA did not address the question of the proprietary nature of models under development nor did it address the delivery requirement of contracts for model development.

GAO's Evaluation and Additional Information

EPA officials stated that they do not plan to take any additional actions at this time on the Subcommittee's question dealing with delivery requirements and models available to EPA without restrictions. They said this question was overlooked in the September 19, 1986, reply. Because EPA did not examine all contracts as requested by the Subcommittee and has no plans to do so, we reviewed 9 of 11 current contracts and 4 interagency agreements for model development. As of July 1987, EPA had 17 major models under development, including

- 2 being developed in-house,
- 11 being developed with contracts as the legal instruments, and
- 4 being developed with interagency agreements as the legal instruments.

Contractual Instruments

Nine of the 11 contracts include an enforceable obligation to provide the delivery for which EPA contracted and require the delivery of models that will be fully available to EPA without restrictions. We believe it was not necessary to review the requirements of the other two contracts because in both cases preliminary versions of the models have already been delivered to EPA.

Interagency Agreements

None of the interagency agreements require the delivery of an operational model. One agreement calls for the continued development of two models; another calls for a preliminary version of a model to be delivered; and the last calls for the development of a module of a model.

Although proprietary products are generally not an issue in interagency agreements, the development of the RADM has presented a potential problem of proprietary data. Under an interagency agreement, the National Center for Atmospheric Research (NCAR) was to develop the RADM for EPA. In late 1986, NCAR decided to substantially decrease its involvement in the RADM development project because the project had moved from basic research to model development. Because of the primary need for timely and credible completion of the overall model development project, EPA's project officer suggested that the RADM project be moved to the Atmospheric Sciences Research Center of the State University of New York at Albany. EPA Chief, Grants Administration Division, agreed with the suggestion. The principal investigator for the RADM project at NCAR moved to the State University of New York at Albany and continued as the principal investigator.

On January 2, 1987, EPA amended the interagency agreement with NCAR to delineate the responsibilities of NCAR and the State University of New York at Albany. EPA is currently negotiating with the State University of New York at Albany for a cooperative agreement for the completion of the RADM. NCAR remained on the project; pledged full commitment to the completion of the research and development phase of the RADM project; and promised to facilitate a smooth transition of the project to the State University of New York at Albany.

The State University of New York at Albany is scheduled to complete the development stages of the RADM by revising and improving modules of the model and ensuring that the computer code for the final version of the RADM is adequately annotated and traceable to scientific documents describing the model. According to the interagency agreement, this documentation must conform to federal documentation standards. EPA's next phase, according to an EPA official, will be the evaluation of the RADM to detect and correct any problems in the model before it is used.

According to an EPA official, EPA had initially planned to issue a request for proposal for a competitive contract for an independent evaluation of the model. Before EPA could issue a request for proposal, however, it needed complete documentation on the model for all potential bidders on the contract. However, as of August 28, 1987, the State University of New York at Albany had only delivered the computer program codes and some limited documentation. According to an EPA official, this information would have been insufficient for potential bidders on the envisioned request for proposal.

Because of the limited amount of documentation available, the knowledge of the model by the principal investigator at the State University of New York at Albany, and the need to move the RADM into the evaluation phase as soon as possible, EPA plans to issue a sole source cooperative agreement for the evaluation phase, at an estimated cost of $20 million, according to EPA officials.

As mentioned earlier, the RADM also has a potential proprietary problem. According to an EPA official, the RADM principal investigator has included proprietary data in the chemical module of the model. The data, developed by an outsider, deal with the analysis of the wave lengths of sunlight and the effects they have on pollution. As of October 1987, EPA had

not been granted permission to review this portion of the chemical module. EPA has directed the principal investigator either to remove the proprietary data or to gain the release of the proprietary data from its developer.

During September 1987, according to EPA officials, EPA sent one scientist to the State University of New York at Albany to work with the principal investigator until February 1988, to obtain a working understanding of the model. EPA plans to send one additional scientist in the near future. EPA now expects the computer program for the RADM to be delivered by February 1, 1988, with documentation to follow in late 1988. EPA is currently negotiating with the State University of New York at Albany to spell out the requirements discussed above in a cooperative agreement.

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