

24129

REPORT BY THE U.S.

General Accounting Office

EPA's Innovative Technology Program For Waste Water Treatment Needs Better Controls

The Environmental Protection Agency (EPA), which makes grants to municipalities to build sewage treatment plants, gives financial and other incentives to municipalities which use more efficient, innovative sewage treatment technologies in their plant projects

GAO reviewed 70 projects approved for innovative technology program funding in 11 states located in three EPA regions. GAO questioned whether 24 of the projects were technologically innovative, 14 projects could not be assessed because of insufficient information; and 32 projects appeared to be innovative. EPA awarded bonuses totaling \$20.2 million to the projects which were questionable and \$7.3 million to the projects which could not be assessed. Project engineers in two of the three regions generally did not ensure that projects were innovative

Designed to break down the barriers hindering development of innovative technology in wastewater treatment, the program has had limited success. The program does not provide sufficient incentives for consulting engineers and states to take the risk or incur the additional cost of developing innovative projects.

GAO recommends several actions to improve compliance with program objectives. GAO also recommends that EPA seek to establish a demonstration program which would allow it to select promising technologies for communities willing to accept the technologies, directly fund construction and start-up costs, and evaluate operation and project results



124974



GAO/RCED-84-79
AUGUST 20, 1984

029806

Request for copies of GAO reports should be sent to:

**U.S. General Accounting Office
Document Handling and Information
Services Facility
P.O. Box 6015
Gaithersburg, Md 20760**

Telephone (202) 275-6241

The first five copies of individual reports are free of charge. Additional copies of bound audit reports are \$3.25 each. Additional copies of unbound report (i.e., letter reports) and most other publications are \$1.00 each. There will be a 25% discount on all orders for 100 or more copies mailed to a single address. Sales orders must be prepaid on a cash, check, or money order basis. Check should be made out to the "Superintendent of Documents".



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

RESOURCES COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-200800

The Honorable William D. Ruckelshaus
Administrator, Environmental
Protection Agency

Dear Mr. Ruckelshaus:

This report discusses the need for better controls in the Environmental Protection Agency's innovative technology program for waste water treatment.

To address these problems, the report contains recommendations to you on pages 18 and 30. 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 Senate Committee on Governmental Affairs and the House Committee on Government Operations 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 appropriate House and Senate committees; members of Congress and senators from states mentioned in this report; and the Director, Office of Management and Budget. We will also make copies available to interested organizations, as appropriate, and to others upon request.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "J. Dexter Peach", written over a faint, larger signature.

J. Dexter Peach
Director

D I G E S T

A major goal of the federal Clean Water Act is to encourage communities building wastewater treatment plants, funded by grants from the Environmental Protection Agency (EPA), to use more efficient, innovative treatment processes. Innovative treatment processes offer significant potential advantages but are considered risky because they have not been widely used in municipal wastewater treatment projects. Innovative projects receive a 10-percent construction grant bonus in addition to the 75-percent federal grant, and EPA guarantees modification or replacement of those projects which do not work as expected.

Since the program began in fiscal year 1979, EPA has awarded \$70.3 million in construction grant bonuses to communities for wastewater treatment facilities using innovative technology.

GAO reviewed the innovative technology program because it has significant potential to improve wastewater treatment technology and can reduce expenditures for energy, construction, and operation of future projects. GAO reviewed 70 projects which received innovative bonuses in 11 states in three EPA regions to determine (1) whether projects receiving innovative bonuses were technologically innovative, (2) the perceptions of program participants regarding the factors which most encouraged or inhibited use of innovative processes, and (3) alternatives which could improve program acceptance by state and local officials and consulting engineers. The three regions and the 11 states were not selected scientifically but were selected to give broad climatic and geographic coverage of the program. The 70 projects represent 40 percent of the 175 projects approved nationwide.

To determine whether particular projects were technologically innovative, GAO relied primarily on the findings of EPA's technical support group in EPA's Municipal Environmental

Research Laboratory in Cincinnati, Ohio. In cases where there was no review of the proposed projects by the technical support group, GAO depended on the results of reviews by EPA regional project engineers and innovative technology coordinators.

SOME PROJECTS WERE QUESTIONABLE,
OTHERS COULD NOT BE ASSESSED

Inherent in an innovative process is a degree of technological risk; that is, the process has been developed and tested but is not proven through actual use in similar conditions. The process must also yield significant cost and energy savings or other environmental benefits. EPA established a technical support group in its Municipal Environmental Research Laboratory in Cincinnati to assist the EPA regions and the states in evaluating the potential risks and benefits of proposed projects to determine whether they meet the criteria.

The Philadelphia and Chicago EPA regions did not always identify and evaluate factors which would pose sufficient technological risk. Of the 47 projects they approved, 37 projects either were questionable as to whether they were technologically innovative (23) or there was insufficient information for GAO to determine whether the projects were innovative (14). In the Dallas EPA region, 22 of 23 approved projects appeared to be innovative. Overall, most of the projects which GAO questioned may not pose a sufficient degree of technological risk. As a result, EPA awarded bonuses totaling \$20.2 million to the questionable projects and \$7.3 million to the projects which could not be assessed because of insufficient information. (See pp. 5 to 11.)

The primary reasons the questionable projects were approved were:

- The Philadelphia region had no procedures to ensure that a sufficient degree of technological risk was present in the projects. As a result, project reviewers did not consistently assure that projects were technologically innovative.

--In Chicago, the factors used by the regional innovative and alternative technology coordinator in his review of proposed innovative projects did not adequately address the factors which would constitute technological risk.

--Both the Philadelphia and Chicago regions rejected the advice of the Cincinnati technical support group that the processes used in most of the projects they reviewed were not technologically innovative. The regions approved the projects without documenting or explaining the reasons for not following the technical support group's advice. (See pp. 11 to 17.)

BARRIERS TO INNOVATION STILL EXIST

The institutional barriers the innovative technology program was intended to overcome included a reluctance among design engineers and communities to try new technologies, potential performance problems of new technologies, the risk of costly and embarrassing failures, and conservative state design standards. Four years after the program started, the barriers still existed.

In 53 of the 70 projects GAO reviewed, consulting engineers and city officials told GAO that the financial incentives did not affect the selection process. The projects were instead selected because of such factors as the cost-effectiveness of the processes or the ease of operation. (See pp. 22 and 23.)

Even though the consulting engineer's costs often are higher and risks greater for designing an innovative facility, the engineers generally are not compensated for the higher cost or greater risk. If the project does not work as expected, the consulting engineers believe their reputations may be damaged by being associated with such a project.

As an added inducement for communities to accept risk in constructing innovative projects, the program provides a guarantee to modify or replace facilities which do not perform as expected. Five of the 11 states GAO visited discouraged communities from considering the guarantee in deciding on

innovative technology. Because the guarantee is funded from the states' basic construction grant allotment, states were unwilling to fund a project twice in one community--the original grant and the modification and replacement grant--since it would take funds away from another community. (See p. 25.)

State policies can negate the benefit of an innovative process by imposing conservative design or operation standards for innovative projects. For example, one state GAO visited required its communities to build a conventional treatment facility in addition to using an innovative process because the state health department was concerned about the effect the innovative process would have on the land. (See pp. 25 to 26.)

GAO believes that a demonstration program could help overcome the higher risk and potential damaged reputations of consulting engineers and the states' concern over having to fund a project twice if it fails. Such a program would allow EPA to select and fund promising technologies which possess high potential benefits, provide up to 100 percent federal grants directly to communities to fund construction and start-up costs, evaluate operations and project results, and finance any needed modification and replacement costs. This program concept was endorsed by several EPA and state grant program officials in the regions and states GAO visited. (See pp. 27 to 28.)

RECOMMENDATIONS TO THE ADMINISTRATOR, EPA

GAO is making four recommendations to the Administrator, EPA, to improve program administration and to help ensure that only projects which are technologically innovative are approved.

GAO recommends that the Administrator determine the extent to which all EPA regions are ensuring that projects are technologically innovative. Where they are not, he should direct regional administrators to establish procedures to help ensure that projects are technologically innovative. These procedures should include:

- Independently verifying projects for technological risk.
- Sending all proposed innovative technology projects to the Cincinnati, Ohio, technical support group.
- Providing a written explanation of the basis for each project eligibility decision.
(See p. 18.)

GAO also recommends that the Administrator, EPA, establish a targeted demonstration program for potential innovative technologies.
(See p. 30.)

AGENCY COMMENTS

EPA did not address GAO's recommendation that the Administrator determine the extent to which all EPA regions are ensuring that projects are technologically innovative. EPA agreed to independently verify projects for technological risk and to provide a written explanation for project eligibility decisions. EPA disagreed with the recommendation that all projects should be sent to the Cincinnati technical support group for review. EPA stated it has delegated management responsibility to the states and requires technical review to be made at the state or regional level, with the option of sending all innovative projects to the technical support group for review. GAO believes EPA should reconsider its position because the support group has a national and international perspective, technical information, and national experts in wastewater treatment processes that are necessary for adequate technical review but are not generally available at regional or state levels. (See pp. 19 and 20.)

In its draft report, GAO proposed that the Administrator, EPA, determine whether a targeted demonstration program should be established, and that if EPA decided to set up such a program, EPA should seek legislative changes to designate a portion of the innovative program funds for the demonstration program.

EPA agreed with the concept of GAO's proposal about a targeted demonstration program but opposed funding the program from construction grant funds because it would further reduce

grant funding. Consequently, GAO is recommending that EPA should initiate the targeted demonstration program and examine the possibility of using funds from other EPA programs or, if funds are not available, EPA should prepare a justification for additional funds and provide such information to the appropriate congressional committees for their consideration. (See p. 29.)

C o n t e n t s

Page

DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	Management of the innovative program	2
	Objectives, scope, and methodology	3
2	BETTER CONTROL NEEDED TO HELP ENSURE PROJECTS ARE TECHNOLOGICALLY INNOVATIVE	5
	Innovative projects must contain risk and benefits	5
	Some projects were questionable-- others could not be assessed because of insufficient information	7
	Need to improve controls to help assure that projects are technologically innovative	11
	Following policies and procedures led to innovative projects in Dallas	16
	Conclusions	17
	Recommendations	18
	Agency comments and our evaluation	19
3	BARRIERS TO INNOVATION STILL EXIST	22
	Incentives had little effect on process selection	22
	Consultants may not be adequately rewarded for accepting extra risk and effort	23
	Some states do not support modification and replacement guarantee	25
	Some state policies do not encourage new technologies	26
	A targeted demonstration program could help overcome barriers	27
	Conclusions	29
	Agency comments and our evaluation	29
	Recommendation	30

APPENDIX

Page

I	Innovative Technology Projects	31
II	Letter from the Acting Associate Administrator for Policy and Resource Management, EPA, dated September 27, 1983, and GAO's evaluation	34

ABBREVIATIONS

EPA	Environmental Protection Agency
GAO	General Accounting Office
I/A	Innovative and Alternative Technology

CHAPTER 1

INTRODUCTION

Each day billions of gallons of polluted wastewater are treated at municipal wastewater treatment plants across the country. Modern conventional treatment plants use mechanical and biological processes to remove pollutants from the wastewater. The wastewater is exposed to bacteria which consume most of the pollutants. The solids in the wastewater (called sludge) settle to the bottom of large tanks and are removed for use as a soil conditioner or are disposed of in a land fill or incinerator.

In many instances these conventional treatment plants are not the most effective or least costly method of resolving water pollution problems. As a result, the Congress in 1977 established the innovative technology program under the Clean Water Act amendments of 1977 (Public Law 95-217) as a part of EPA's municipal wastewater construction grants program. The intent of the innovative technology program was to reorient the construction grant program away from conventional technology and to increase the use of new and promising innovative technology approaches.

Although such approaches are somewhat more risky because they have not been proven in municipal treatment plant use, they can provide a significant potential benefit in terms of environmental enhancement, lower capital or operating costs, and reclamation, recycling or other beneficial use of wastewater. These benefits are clearly shown in the case of West Monroe, Louisiana, a city which proposed building a conventional wastewater treatment plant. The city found the conventional plant would be too expensive and looked for a cheaper solution. Compared with the cheapest conventional method, the innovative process now being constructed--a rock filter and controlled effluent release system for their existing lagoons--should save the city about \$3.3 million in construction costs and about \$550,000 in annual operating and maintenance costs.

The innovative technology program has several features.

- Innovative technologies receive a federal construction grant of 85 percent instead of the normal 75 percent funding for conventional technologies or, in other words, a 10-percent bonus.
- At least 1/2 percent of each state's construction grant funds must be reserved (set aside) to pay for the 10-percent bonus for innovative technology projects.
- Set aside funds for innovative technology projects must be obligated by the end of the second fiscal year after they are set aside. Funds that are not obligated are reallocated to states that spend their entire set aside.

--If an innovative technology does not perform as expected, the EPA Administrator may award another grant for up to 100 percent of the cost of modifying or replacing the failed system.

Since the program's inception in fiscal year 1979 through June 1983, EPA has funded 205 innovative projects with bonuses totaling \$70.3 million. In addition to the 10-percent bonus (set aside funds), \$525 million in basic 75 percent grants have been obligated for these projects for a total of \$595 million. The following table shows the breakdown of the set aside by year, through June 1983.

<u>Fiscal year</u>	<u>Innovative set aside (estimated)</u>
	(000 omitted)
1979	\$21,003
1980	12,599
1981	12,770
1982	11,975
1983	<u>11,975</u>
Total	<u>\$70,322</u>

EPA estimates that the 205 innovative projects funded under this program will provide savings of about \$200 million over the life of the projects.

MANAGEMENT OF THE INNOVATIVE PROGRAM

The innovative technology program is managed jointly by EPA and the states. Policy and program guidance is provided by the EPA Office of Water Program Operations in Washington, D.C. Responsibility for reviewing and approving grants has been delegated to EPA's regional administrators. Specific responsibilities are detailed in EPA program requirements documents and in delegation agreements between EPA and each delegated state. Generally, the states evaluate projects to ensure all applicable federal regulations are followed. Recommended projects are sent to EPA regional offices for final approval and grant award. Responsibility for the program usually lies with designated state and EPA regional innovative and alternative technology (I/A) program coordinators.

I/A coordinator responsibilities vary somewhat among regions and states, but the coordinators are generally required to (1) coordinate the innovative program in the region or state, (2) review all proposed innovative projects, (3) provide liaison with other EPA and state offices, (4) train EPA and state personnel, (5) advise the regional administrator or state pollution control officials on innovative policy and decisions, and (6) chair regional or state advisory committees. Technical

advice for the program is provided by the technical support group in EPA's Municipal Environmental Research Laboratory in Cincinnati, Ohio. The technical support group also maintains an innovative technology clearinghouse, which is intended to ensure that technical information about innovative projects will be adequately disseminated nationwide.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our objective was to determine the extent to which the innovative technology grant program was achieving the congressional goal of increasing the use of technologically innovative processes. To accomplish this objective we evaluated (1) the projects which received innovative bonuses to determine whether they were technologically innovative, (2) the perceptions of program participants regarding the factors which most encouraged or inhibited use of innovative processes, and (3) alternatives that could improve program acceptance.

We selected the innovative technology program for review because it has significant potential to improve wastewater treatment technology and can save energy and construction costs for future projects.

We reviewed 70 (40 percent) of the 175 projects approved nationwide for innovative funding between October 1978 and April 1982. The 70 projects included all innovative projects approved and funded in 11 states. These states were located in three EPA regions (Region III, Philadelphia; Region V, Chicago; and Region VI, Dallas). A list of the 70 projects is included as appendix I.

The three regions and the 11 states were not selected scientifically but were selected to give a broad climatic and geographic representation of the program. The projects selected provided a wide range of capacities (wastewater treated ranged from 10,000 gallons per day to 170 million gallons per day) and grant size (total grants ranged from about \$26,000 to \$82 million). The projects involved both new construction and expansion or improvement of existing municipal wastewater treatment plants.

We reviewed authorizing legislation, construction grant regulations, and the I/A assessment manual which provides direction to federal and state review authorities and the criteria for evaluating innovative projects. We also conducted a search of available literature on innovative wastewater treatment and reviewed the legislative history of the Clean Water Act.

For each of the 70 projects, we reviewed EPA and state project files to determine the justification and logic for the innovative determination. We examined the Cincinnati technical support group's reviews for 31 of the 70 projects, decision/justification documents, facility plans and designs,

correspondence, grant award documents, and innovative technology clearinghouse reports.

To assess whether particular projects were technologically innovative, we relied primarily on the findings of EPA's Cincinnati technical support group. In some cases where EPA approved several projects employing the same technology, the support group reviewed only one of the projects. In cases where there was no review of the proposed technology by the technical support group, we asked EPA regional project engineers and I/A coordinators to review the projects and in those cases we depended on the results of those reviews for our determination.

We did this work between October 1982 and April 1983 at the following locations:

- EPA offices in Washington, D.C; Cincinnati, Ohio (Municipal Environmental Research Laboratory); Ada, Oklahoma (Robert S. Kerr Environmental Research Laboratory); Philadelphia, Pennsylvania; Chicago, Illinois; and Dallas, Texas.
- State program offices in Pennsylvania, Maryland, Virginia, West Virginia, Minnesota, Illinois, Texas, Oklahoma, Louisiana, and Arkansas.
- Municipalities (grantees) in Pennsylvania (2), Maryland (4), Virginia (4), Minnesota (3), Illinois (3), Texas (1), Oklahoma (1), and Arkansas (3).
- Offices of consulting engineers who designed the wastewater treatment projects.

Through interviews, we obtained information on policies and procedures for the innovative program; barriers which impede use of innovative technology; incentives needed to encourage increased use of innovative technology; and options to improve the program. We obtained this information from the EPA national directors of the Water Program Operations and Municipal Construction Divisions, the national I/A program coordinator, regional construction grant branch and section chiefs, EPA and state I/A coordinators, EPA and state project engineers, municipal officials, and consulting engineers.

We made this review in accordance with generally accepted government auditing standards.

CHAPTER 2

BETTER CONTROL NEEDED TO HELP ENSURE

PROJECTS ARE TECHNOLOGICALLY INNOVATIVE

To be technologically innovative a project must contain a degree of risk which is necessary to initially demonstrate a method on a full operational scale. In addition, a technologically innovative process must offer the community cost or energy savings or other environmental benefits which exceed those offered by conventional methods.

Of the 70 projects funded as innovative in our sample, we questioned whether 24 (34 percent) were technologically innovative, 14 (20 percent) could not be assessed because of insufficient information, and 32 (46 percent) appeared to be technologically innovative. Most of the 24 projects may not contain the element of technological risk which is implicit in innovative technology. As a result, EPA awarded innovative bonuses totaling \$20.2 million to the 24 projects which were questionable and \$7.3 million to 14 projects which could not be assessed because of insufficient information. Twenty three of the 24 projects were in EPA's Chicago and Philadelphia regions.

INNOVATIVE PROJECTS MUST CONTAIN RISK AND BENEFITS

In debate on the 1977 and subsequent amendments to the Clean Water Act, the Congress made it clear that inherent in technological advancement under the innovative grant program is the recognition and acceptance of an element of risk, that risks are acceptable in light of the potential benefits, and that risk is the reason why the Congress authorized EPA to modify or replace systems which fail to perform as intended. EPA's guidelines state that a degree of risk is necessary when first demonstrating a new technology in full scale operation but caution that risk must be minimized by funding only those projects which are fully developed and shown to be feasible. The regulations also state that the risk must be commensurate with potential benefits.

Technological risk for a wastewater treatment process may be affected by a number of variables including geographic conditions, climate, level of pollutants in the wastewater, level of treatment required, number of similar facilities in operation, and reliability of information about the process. For example, EPA's technical support group reviewed a proposed innovative project using a process called a biological aerated filter. The process involves an aerated filter which uses microorganisms growing in a filter media to consume and filter out organic pollutants. The technical support group concluded that the process was technologically innovative primarily because (1) the data on which the design was based was not independently verified, (2) information on the performance of some system components was not available, and

(3) the climate, strength, and flow of the wastewater were different in the test facilities than in the proposed facility. These factors could affect the performance of the project.

Projects that meet the guidelines and general definition of innovative technology should also meet at least one of six other criteria which define the extent to which the projects provide benefits in terms of meeting Clean Water Act goals. These include

- life cycle cost savings¹ of at least 15 percent compared to the most cost-efficient conventional approach,
- energy savings of at least 20 percent compared to the most energy-efficient conventional approach,
- improved reliability in the operation of the treatment plant,
- better treatment of toxic materials,
- increased environmental benefits such as water conservation and more effective land use, and
- new or improved methods of treating municipal and industrial wastes discharged into a municipal sewage system.

EPA regional administrators under so-called "regional discretion" may also determine that a system is innovative if the system incorporates unique design and operational features due to local variations in geographic or climatic conditions, or if the design achieves a significant public benefit through the advancement of technology that would not otherwise be possible. Under EPA procedures to use the latter criteria, the region must fully document and quantify both the technical advancement and the achievable public benefit. According to EPA's I/A assessment manual, using the regional administrator's discretion should be on a selective basis for projects which exhibit high potential toward achieving the goals of the Clean Water Act but do not otherwise qualify.

The EPA regions are responsible for assuring that proposed projects meet the innovative criteria. To assist in this role, EPA designated its Municipal Environmental Research Laboratory in Cincinnati, Ohio, to provide technical support for the review of projects. That assistance flows from the laboratory's mission to develop and demonstrate new and improved technology and methods to prevent, control, and treat pollutants from municipal wastewater. Many of the laboratory's staff of scientists and engineers are recognized as national experts in various wastewater treatment processes. The staff has ready access to other scientists and

¹Life cycle costs includes capital construction costs plus operation and maintenance costs less revenues generated by the facility over the estimated useful life of the project.

engineers knowledgeable about the technological processes and about the general engineering areas being evaluated. The staff also has access to ongoing research at the Cincinnati laboratory and at universities and private companies. While this information can be obtained by the EPA regions and states, it is much more readily available in the Cincinnati laboratory.

EPA's regulations and guidelines do not require that the regional offices obtain the technical support group's opinion on whether the proposed project meets the technological risk and other criteria. EPA's procedures state that requests for technical support group assistance should be limited to those situations where issues relating to the innovative technology cannot be resolved in the regional office. The regional offices use their judgment on whether to involve the technical support group. EPA regulations are silent with regard to the disposition of the technical support group's recommendations.

The technical support group reviews projects as requested by project engineers and I/A coordinators in the regions and states. A full-scale review covers technical risk, claimed benefits, proposed results, and the appropriateness and accuracy of information on a baseline against which the cost and energy savings are measured. Risk is assessed by determining what factors affect the performance of the system (climate, geography, and wastewater strength) and how these factors differ in existing plants and the proposed plant.

SOME PROJECTS WERE QUESTIONABLE--
OTHERS COULD NOT BE ASSESSED
BECAUSE OF INSUFFICIENT INFORMATION

We reviewed 70 projects² that received funding through the innovative technology grant program. Of these we questioned whether 24 projects were technologically innovative. Twenty-one of the 24 may not pose sufficient technical risk to constitute innovative technology, 2 were not wastewater treatment processes, and 1 was awarded innovative funding before a treatment process had been selected. Fourteen of the 70 projects could not be assessed because there was insufficient information, and 32 projects appeared to be technologically innovative.

The following table shows our classification of the 70 projects by region.

²One Chicago project included two separate innovative processes, and each received an innovative grant. We considered both processes as separate projects in this report. We concluded that one project was questionable and the other could not be assessed.

<u>EPA Region</u>	<u>Innovative</u>	<u>Questionable</u>	<u>Could not be assessed</u>
Philadelphia	5	11	8
Chicago	5	12	6
Dallas	<u>22</u>	<u>1</u>	<u>0</u>
	<u>32</u>	<u>24</u>	<u>14</u>

As shown in the table, 23 of the questionable projects were in the Philadelphia and Chicago regions; all but one of the Dallas projects were technologically innovative.

Most questionable projects appear to pose little if any technological risk

The states and regions generally considered that projects posed sufficient technological risk if the processes were not commonly used in the state or region. EPA regulations and guidance state that an innovative technology is one which, although technically developed and feasible has not been fully proven under circumstances of its intended use. Information available in the EPA and state project files showed that the processes for 21 projects funded as innovative had in fact been demonstrated in similar circumstances. In some cases they were demonstrated hundreds of times nationwide, and in other cases they were demonstrated by one or more well-documented projects.

For example, in August 1981 Virginia proposed funding several treatment plants incorporating oxidation ditches as innovative technology. According to the EPA project engineer, these projects were considered innovative because oxidation ditches had never been used in the state. An oxidation ditch is a closed loop channel which uses a conventional activated sludge treatment process and was developed in the 1950's. According to a 1978 EPA study, the oxidation ditch is capable of consistently achieving high levels of treatment, is cheaper than other comparable conventional treatment processes to build and operate, and can be operated with minimal operator attention. As of 1975, there were 558 plants using oxidation ditches operating in 40 states, and about 90 such plants were being constructed each year. The technical support group concluded that oxidation ditches were fully proven and did not qualify as innovative technology. The group also concluded that a technology should not be considered innovative simply because it had not been approved or accepted by local designers. According to the support group, 558 installations should have been sufficient to prove that oxidation ditches work.

Risk is not always determined by the presence or absence of a large number of comparable applications. Risk may also require an examination of one or more specific environmental factors such as quality of the wastewater, climate, or geography. For example,

three projects were funded as innovative in Maryland with the innovative portion totaling about \$500,000. The projects involved ultra-violet irradiation to kill harmful bacteria in the wastewater effluent. The projects were designed to meet state limitations on chlorine in natural trout streams. Technological risk was not addressed by the consulting engineer or by the EPA project engineer at the time these projects were approved. For example, the EPA project engineer responsible for the Smithburg project said he approved it because there were no other ultraviolet disinfection processes in use in Maryland. According to the Chief of EPA's technical support group, ultraviolet irradiation works very well with little risk of failure for relatively clean wastewater, but risk increases as the amount of pollutants in the wastewater increases. The Philadelphia regional I/A coordinator agreed with this assessment that these projects had little risk of failure and should not have been classified as technologically innovative.

Albany, Minnesota, proposed expanding its single cell stabilization pond and using a motor boat to mix alum in the ponds to remove phosphorus from the effluent. In the proposed \$1.9 million system, 4 ponds totaling about 60 acres would store and treat wastewater for about 6 months. Just before discharging the treated effluent from the ponds, alum would be dispersed in the ponds and mixed by the boat's propeller. The state and EPA region concluded that these processes posed sufficient risk because they had not been demonstrated in the United States. The technical support group concluded that it was not innovative because the proposed system had been demonstrated in full-scale operation in Ontario, Canada. The support group cited three studies based on the Ontario experience which adequately showed that the processes contained little risk and were considered fully proven technologies and thus was not technologically innovative. Although the support group concluded the process was not innovative, EPA regional officials approved the project for innovative funding without an explanation of the reasons for rejecting the technical support group's recommendations.

The City of Tulsa, Oklahoma, proposed adding a \$518,000 waste heat recovery and reuse system as part of its northside plant expansion project. The process involved recovering heat from an engine-driven generator and using it in the sludge heating system. The process which received innovative funding was justified as risky by the I/A coordinator because it was not fully proven in the Dallas region, a position with which the technical support group disagreed. The support group found that the technology has been in common use since the 1930's. With the advent of inexpensive energy in the 1950's and 1960's, interest in energy recovery waned and few new installations occurred. Although this might give the appearance of an unproven process, the technology has been around for 50 years, and the support group concluded that the process should not have qualified as innovative.

Projects could not be assessed
because of insufficient information

Fourteen projects could not be assessed because (1) in our examination of the project files we did not find sufficient evidence to demonstrate that they were technologically innovative and (2) the EPA project engineer or I/A coordinator could not explain how the project was technologically innovative. These projects either were not reviewed by the technical support group or were reviewed but there was not enough information for them to draw a conclusion. It is possible that the 14 projects might have been technologically innovative; however, the files did not substantiate EPA's approval decision. For example, the Chicago region approved a \$550,000 ultraviolet disinfection system as innovative for Albert Lea, Minnesota, yet there was no information in the region or state files to show that risk was addressed; project engineers and the I/A coordinator could not explain what technological risk was posed by the project. The Philadelphia region approved a \$1 million aeration system as innovative for Crab Orchard, West Virginia, without any evaluation of whether the system possessed technological risk. The grantee's consulting engineer who prepared the facility plan did not address risk except for the comment that the process had attained wide acceptance. The facility plan also contained no discussion of the environmental factors which would determine whether the process posed risk.

Some projects appeared to be innovative

Thirty-two of the 70 projects appeared to be technologically innovative; that is, they posed a sufficient degree of technological risk and advanced the state of the art. Twenty-two of the 32 innovative projects were funded in EPA's Dallas region and 5 each in Philadelphia and Chicago. The 32 innovative projects employed 16 different types of technology ranging from complete treatment systems such as overland flow to single components such as filters or disinfection units. The most common innovative process was overland flow which was funded 13 times in the Dallas region.

Overland flow is a land-application form of wastewater treatment in which wastewater is discharged along the top of a gently sloped field. Plants growing on the field and microorganisms on the soil surface are the primary mechanisms for removing pollutants. The treated wastewater flows down the hill into runoff collection ditches for discharge. The plants growing on the field are suitable for cattle feed.

Other innovative processes which were funded included:

--Aquaculture where aquatic plants such as the water hyacinth are used to remove nutrients and solids from wastewater treatment lagoons. The plants harvested from the lagoons can be processed for fertilizer, animal feed, or methane gas.

--Waste effluent (waste pickle liquor) from a steel mill is used for phosphorous removal at the municipal treatment plant.

NEED TO IMPROVE CONTROLS TO HELP ASSURE
THAT PROJECTS ARE TECHNOLOGICALLY INNOVATIVE

All but one of 38 projects which we questioned as being technologically innovative or which could not be assessed were in the Philadelphia and Chicago regions. Philadelphia did not have regional procedures on how to evaluate projects to assure they are technologically innovative. In Chicago, the factors used by the region's I/A coordinator in his review of proposed innovative projects did not adequately address the factors which would constitute technological risk. Both regions usually rejected the advice of the Cincinnati technical support group without documenting or explaining the reason for not following the support group's advice. Neither region provided the required written explanations of their basis for using regional discretion to approve projects. Dallas, on the other hand, established and followed a consistent set of policies and procedures which almost uniformly assured that projects were uniformly considered for technical innovation.

Philadelphia did not have controls
to ensure a sufficient degree of
technological risk

Project engineers in Philadelphia did not always examine factors which would pose technological risk in their evaluation of innovative grant applications. The region had not prepared procedures to ensure that a sufficient degree of technological risk was present in projects considered under the innovative grant program. Further, Philadelphia had not trained the project engineers in the evaluation of technological risk. Five of the 24 project files contained evidence to show that the project engineers had evaluated the projects in relation to risk.

The region has a project engineer for each state. When a state submits a wastewater treatment grant application, the project engineer reviews the documentation to ensure that all applicable federal regulations are followed and that all information necessary to evaluate the project is included in the case file. The I/A coordinator told us that as part of this process, each project engineer was responsible for evaluating and approving or disapproving the innovative funding.

Once the project engineer determines that the project meets the innovative criteria, he/she prepares grant award documents and forwards them through the appropriate regional branch chief to the Regional Director, Water Division, for approval. At the time of our review, the regional administrator had delegated approval authority to the division director. The approval authority has since been returned to the regional administrator.

Project engineers we spoke to had different ideas about their role in the innovative determination process. One project engineer told us that the determination as to whether a process was innovative was delegated to the states and that EPA should not review the projects to determine whether they meet the criteria. Another project engineer said all potential innovative projects had to go to the regional I/A coordinator, who was responsible for the innovative determination and who decided whether to seek the technical support group's advice. A third project engineer said the I/A coordinator was to be used in cases where the project engineer needed assistance.

The I/A coordinator said the project engineers had not been given training in how to apply the innovative criteria. He attributed this to the fact that higher priority programs prevented him and the project engineers from spending enough time to properly implement the program. The I/A coordinator said he generally spent 5 to 10 percent of his time on the innovative program. He said this was not enough time to provide training for project engineers, liaison and training for state and local officials, or to monitor the program.

Actions resulting from our review

In January and February 1983, following our work in Philadelphia, the region took several actions to strengthen the management controls over the innovative program. Actions taken included: (1) drafting procedures for reviewing and approving innovative projects, (2) formal training for the project engineers, (3) reviewing and correcting innovative project information in EPA's centralized grant information system, and (4) reviewing all innovative project files to determine whether the projects could be brought into compliance with the criteria.

As a result of reviewing the files for projects included in our review, the region has classified the Hagerstown and Oakland, Maryland, projects as innovative and terminated innovative funding for the Poplar Hill and Maryland City, Maryland, and Grottoes, Virginia projects.

The Chicago I/A coordinator did not consider factors which would pose a sufficient degree of technological risk

EPA's Chicago region designates a project engineer for each state. When a state submits a wastewater treatment grant application, the state project engineer reviews the documentation to ensure that all applicable federal regulations are followed and that all information necessary to evaluate the project is included in the case file. If the state requests innovative funding for the project, the project engineer then forwards the file to the regional I/A coordinator, who reviews the data on the proposed technology. If the Cincinnati technical support group has not reviewed a project with similar technology, the region asks the

technical support group for its advice before a final determination is made.

Once the technical support group's comments have been received and considered, the I/A coordinator determines whether the project should be designated as innovative. The I/A coordinator then prepares a memorandum documenting his findings, including his rationale for the decision and, in some cases, addressing issues the technical support group has raised. The application file along with the innovative determination is then forwarded to the regional administrator for final approval.

We questioned whether 18 of the 23 projects approved for innovative funding posed the requisite degree of risk to be technologically innovative. This resulted primarily from the I/A coordinator's not adequately considering technological risk. The I/A coordinator told us he does not use risk as a factor in evaluating or determining the justification of a project. Instead he looks more at the potential benefits of the project. He said he had trouble dealing with the concept of risk because it is very nebulous and a project is only truly risky if there is no model to follow. The I/A coordinator also said that it is difficult to compare the use of a technology in one state versus another state because effluent standards are different; permit limitations and performance requirements are not the same; and climate conditions, rain fall, and temperature can affect plant operation.

The following example shows a case in which the factors used to justify projects were not the factors which would necessarily make the projects technologically risky. The project in Illinois involved upgrading an existing lagoon by adding sand filters. The justification for the project stated the use of the single cell lagoon followed by sand filters was a new application in Illinois. The state felt the process was risky because (1) the frequency of cleaning of the filter beds was not known, (2) the impact of cold climate was a concern, (3) the impact of effluent quality might have adversely impacted the sand filters, and (4) the algae size and impact on the filter were not known. For these reasons, the state and the Chicago region considered the process to possess sufficient technological risk.

Two EPA technical reports showed that the four concerns expressed by the state did not affect risk in the project. For example, the state justification said the quality of the effluent might adversely impact the sand filters. The reports concluded that the quality of the effluent did not significantly affect the systems operation. The reports showed that the proposed technology was most affected by proper operation and maintenance and properly trained operators. For these reasons, the technical support group concluded that this technology did not present enough risk to qualify as innovative.

The I/A coordinator rejected the technical support group's recommendation without presenting additional evidence to show that

the state's concerns presented sufficient risk to constitute innovative technology.

Technical advice was rejected
without explanation

The EPA technical support group in Cincinnati was formed in 1979 to assist the regions by reviewing proposed innovative projects. We were told by both EPA and state officials that the technical support group provides a vital service that could not be performed by the regions or states.

The three regions in our review submitted 37 of the 70 projects to the technical support group for review. Dallas, which submitted 20 of its 23 projects to the technical support group, generally followed the support group's recommendations. The Philadelphia and Chicago regions, which submitted 17 of their 47 projects, however, frequently rejected the comments and recommendations and did not document or explain the reasons for not following the support group's advice. EPA regulations are silent as to the disposition of the advice.

Eight Philadelphia region projects were reviewed by the technical support group, and the group recommended approval for only one. The group said two projects were definitely not innovative, and for the remaining five they believed the documentation was insufficient to make a decision. The region approved all eight projects as innovative. The regional project officials did not document or explain why they did not address the issues raised by the technical support group. For one project, the technical support group review was not received in the region until after the grant was awarded.

The City of Grottoes, Virginia, requested innovative bonuses for four separate portions of its wastewater treatment plant-- pumps, a lagoon, a clarifer system, and an aeration system. The technical support group reviewed the request and had the following comments:

- The pumps potentially pose a degree of technological risk, but further documentation is needed on the relative efficiency, durability, and availability of the equipment.
- The aerators and lagoon are fully proven technology which do not contain significant risk elements and are considered conventional technology.
- The clarifer system constitutes excessive technical risk since no documentation was provided to support the manufacturer's claims.

In examining project files and interviewing the project engineer and I/A coordinator, we found no evidence that the EPA project engineer investigated these issues. According to EPA

records, the aerator, lagoon, and clarifier (classified by the technical support group as either not risky or too risky) were funded as innovative and the pump (the potentially innovative process) was not. No justification was prepared to support the decision.

The Chicago region submitted 9 of its 23 projects to the technical support group for review. The group recommended approval for three projects and rejection for six projects. In addition, one of the six projects that was rejected by the group--the lagoon with sand filter--was given innovative funding six other times in the region, so in effect the technical support group recommended that 12 of the region's 23 projects be rejected. The reasons cited by the I/A coordinator for not following the support group recommendations were that the processes were not proven in the state or region or that the processes represented improvements over the existing state of the art. According to the technical support group, the fact that a process is not proven in a state or region or represents an improvement over current technology does not make it risky. What makes it risky generally is the extent to which factors, which could cause the process to fail, have been proven in a similar climate or geography.

Regional discretion used
for marginal projects

EPA regulations and guidelines allow regional administrators to selectively approve as innovative those projects which exhibit a degree of technological risk as well as high potential towards achieving the goals of the Clean Water Act but, due to the unique nature of the technology or system design, may not strictly qualify under the cost, energy, or improved application criteria. Regional discretion may be used where the regional administrator determines that

- a treatment system is innovative because of local variations in geographic or climatic conditions which affect treatment, plant design, and operation or
- the design achieves significant public benefit through the advancement of technology that would not otherwise be possible.

Under EPA procedures to use the latter criteria, the region must fully document and quantify both the technical advancement and the achievable public benefit. There is also extensive EPA guidance on factors regional administrators must include in the documentation and the priorities to follow in the decision process.

The three regions used regional discretion to approve 29 of the 70 projects. Most of these (19) were in Chicago, with 7 in Philadelphia and 3 in Dallas. Seven of the 29 projects met

the regional discretion criteria. In Chicago where 19 of the 23 innovative projects were approved using regional discretion, 4 of the 19 fully documented and quantified the technical advancement and achievable public benefit. In explaining the region's use of discretion, the regional I/A coordinator said it was used when a project was better than the existing technology in the state or region, even though the technology may not contain sufficient technological risk. The coordinator's consideration of regional discretion is not consistent with EPA's regulations and guidelines which regard technological risk as an essential element of innovative technology.

For example, the Chicago region approved a project in Elsau, Illinois, as innovative by using regional discretion. The project was described by the project engineer as a compact arrangement of conventional treatment plant processes which represented an innovative application of these technologies in order to meet the local geographic and aesthetic requirements of the community. The I/A coordinator considered the project to be risky because the "compact nature of the plant represents a reasonable risk in relation to proper operation and maintenance functions." Further the Chicago region did not demonstrate any increased technological risk in this project nor did it document and quantify the technological advancement and achievable public benefit. The technical support group found the proposed treatment process was fully proven and fully demonstrated and did not consider placing a conventional treatment plant inside a small structure to conform to EPA regulations for innovative funding.

FOLLOWING POLICIES AND PROCEDURES LED TO INNOVATIVE PROJECTS IN DALLAS

The EPA Dallas region and its states instituted policies and procedures to foster innovative technology and to ensure all projects were technologically innovative. As discussed on pages 8 and 11, all but one project in the Dallas region demonstrated sufficient technological risk and the criteria of the innovative program. The major features of the region's program include strong support from regional and state officials, and thorough and consistent review of proposed innovative projects by the technical support group and a regional advisory group.

Support for the program includes continuity in staff resources and active education efforts. The regional and state I/A coordinators, the principal officials responsible for the program, have been with the program since its inception. The regional I/A coordinator said he spends about 75 percent of his time on the program. State I/A coordinators spend up to about 35 percent of their time on the program.

The regional I/A coordinator arranged a number of seminars on innovative technology in the region. These include seven planned or given in fiscal years 1983 and 1984. He has also arranged seminars by state university extension services in Arkansas and

Texas and planned seminars in Oklahoma, New Mexico, and Louisiana. The I/A coordinator in Arkansas also compiled and maintains a list of publications regarding innovative technology. The list was sent to consulting engineers in the state.

Dallas regional procedures require each innovative project to be reviewed by the Cincinnati technical support group and a regional ad hoc support group. The technical support group reviews data submitted by the region to determine whether projects meet the innovative criteria and whether projects contain technological risk. The ad hoc support group, on the other hand, has a somewhat broader role to advise the regional administrator on technical, legal, and programmatic issues. The ad hoc group generally follows the technical support group's recommendation but is not bound by it and may consider other issues. The ad hoc support group provides a means to keep the I/A coordinator, as its chairman, informed about innovative projects, provides a regional perspective to the review process, and serves to ensure that project engineers are following procedures and are responding to the technical support group's concerns. Based on these reviews, the ad hoc support group advises the regional administrator whether to approve the project.

All but one of the region's proposed innovative projects were reviewed by the technical support group, the ad hoc support group, and in the case of proposed land treatment processes, by the EPA laboratory in Ada, Oklahoma. In only one case, as discussed on page 9, was the technical support group's recommendation not followed by the regional administrator, because the I/A coordinator believed the technology was not fully proven in the region.

CONCLUSIONS

The Congress recognized that increased technological risk was inherent in the advancement of wastewater treatment processes and technologies which the Congress sought to encourage through the innovative technology grant program. Only 10 of the 47 projects receiving innovative funding in the Philadelphia and Chicago regions clearly demonstrated a sufficient degree of technological risk to be classified as innovative. Of the remaining projects, we questioned whether 23 included sufficient risk to be technologically innovative, and 14 could not be assessed because of insufficient information. In the Dallas region 22 of its 23 projects appeared to be technologically innovative.

Most of the questionable projects may not pose sufficient technological risk; most appear to be conventional, well known, and frequently used processes. The reasons the projects were approved were:

- The Philadelphia region did not have procedures on how to evaluate projects and had not trained its project engineers on how to apply the innovative criteria.

- In Chicago the factors used by the regional I/A coordinator in his review of projects generally were not factors which would pose additional technological risk.
- Both the Philadelphia and Chicago region's I/A staffs rejected the advice provided by the Cincinnati technical support group.
- Neither region provided the required written explanation of the technological advancement and achievable public benefit for many of the projects approved as innovative.

Carrying out the objectives of the innovative technology program will take a more concerted effort by EPA. Generally, the regional administrators need to pay closer attention to the evaluation and decision process. The process of evaluating decisions on innovative projects will require that the regional I/A staff be trained in identifying and evaluating factors which constitute technological risk and that the I/A coordinator and regional administrator ensure that technological risk is evaluated. This will require the regional administrator to independently verify that projects are technologically innovative.

The Cincinnati technical support group was set up to help the regions assure that the projects are technologically innovative. The group includes a staff of scientists and engineers recognized as national experts in various wastewater treatment processes. EPA and state program officials also agreed that the technical support group provided a vital resource that could not be performed by the region or states. These factors demonstrate to us that the technical support group should be required to evaluate the proposed projects as part of the regional administrator's independent verification, and the regions should follow the support group's conclusions unless otherwise justified by the regional administrator. The regions should also ensure that the basis for each innovative project funding decision is well documented.

RECOMMENDATIONS

To help ensure that the objectives of the innovative technology program are achieved, we recommend the Administrator, EPA, determine the extent to which all EPA regions are ensuring that projects are technologically innovative. To the extent they are not, we recommend the Administrator direct regional administrators to establish procedures which will help ensure that the factors constituting technological risk are identified and evaluated. The procedures should include having the regional administrator

- independently verify that all proposed innovative projects are thoroughly and systematically evaluated for technological risk including projects proposed under regional discretion authority;

- send all innovative project requests to the Cincinnati technical support group for review; unless actions to the contrary are appropriately justified, the regions should be required to follow the support group's recommendations; and
- provide a written explanation of the basis for each innovative decision including the evaluation of risk and potential benefits and actions taken on the technical support group's recommendations.

AGENCY COMMENTS AND OUR EVALUATION

EPA responded to our draft report on September 27, 1983. (See app. II.) EPA said that in criticizing the EPA regions for failure to properly assess "risk" in determining whether a project is innovative, we should recognize that overall risk includes both "technical risk" and "institutional risk." EPA defined technical risk as based on scientific and engineering analysis, whereas institutional risk was less objective and was characterized by such factors as the reluctance of engineers to try new technologies because of possible damage to their professional reputations if the project were to fail to perform as proposed; the reluctance of state agencies to approve the first installation of a new technology in their state; and the reluctance to spend public funds, whether federal grant or local funds, for technologies where there may be a substantial degree of technical risk. EPA said the program was intended to address both kinds of risk, so it was not unusual that we may have found that some projects were funded even though they apparently failed to meet technical risk criteria considered by the technical support group.

We recognize that the innovative technology program was intended to address both technical and institutional risk. However, in enacting the innovative technology grant program, the Congress sought to encourage the advancement of wastewater treatment processes and techniques and recognized that a degree of technological risk was inherent in such technological advancement. EPA guidelines and procedures recognized that a greater degree of technological risk is inherent in innovative technology under this program. Because of the importance of technological risk, the objective of our review was to determine the extent to which the program was achieving the congressional goal of increasing the use of technologically innovative processes (chapter 2). Additionally, we assessed the progress made in overcoming the barriers to use of innovative processes (chapter 3).

EPA commented that designating a project as innovative involved a large amount of judgment. EPA agreed that the regional files did not always clearly document the basis for the decision but that the lack of documentation was not evidence that the project decision did not comply with EPA's policy and guidance.

As described in chapter 1 of our report, our evaluation of projects awarded innovative grant funding was based on evaluations by the technical support group, the documentary record of EPA's review of the project, and statements by EPA regional officials. Instances where we have questioned whether a project was technologically innovative have been based on the arguments and conclusions of the technical support group and/or statements by EPA regional project engineers or I/A coordinators that a particular project or process was not technologically innovative. Additionally, we considered whether these arguments and conclusions had been rebutted in the documentary record of EPA's review and approval of the project.

EPA did not respond to our recommendation that the EPA Administrator determine the extent to which the EPA regions were following the innovative criteria. EPA agreed with our recommendations concerning an independent verification of the eligibility of proposed projects, and the documentation of eligibility decisions.

EPA stated that we should recognize that the regulations specifically allow a project to be designated as innovative even through the same or similar innovations may have been tried successfully at several other locations.

We did not criticize EPA for this practice. The regulations allow an innovative process to be funded at several locations. However, we question whether some of those multiple projects are technologically innovative.

EPA disagreed with our recommendation to send all innovative project requests to the technical support group for review. EPA stated that the report did not consider that the recommendations of the technical support group are one of several factors that enter into the approving/funding decision. EPA also stated that the technical review is currently required to be carried out at the state or regional level with the option to send individual projects to the technical support group for review. EPA believes this is appropriate as long as the basis of the innovative decision is sound, consistent with the regulations, and documented in the project files.

The basis for our recommendation is that the technical support group provides capabilities and expertise (see pp. 6 and 7) not readily available in the states or regions. These include a national and international perspective, extensive technical information, and a staff of scientists and engineers, many of whom are recognized as national experts in various wastewater treatment processes. The technical support group provides an independent technical review to determine if projects comply with the innovative criteria. Our recommendation was intended to ensure that the technical support group's technical expertise is brought to bear on the decisionmaking process. We agree that the state or regional office should make the final project eligibility decision

but believe that the technical support group's input should be obtained and carefully evaluated and responded to as part of the decisionmaking process.

Two of the three regions we reviewed--Philadelphia (region III) and Chicago (region V) provided detailed comments on our project eligibility determinations. (See app. II.) Our response to the comments is contained in the appendix.

CHAPTER 3

BARRIERS TO INNOVATION

STILL EXIST

The innovative technology program was established by the Congress to overcome barriers which inhibited the use of newer, more efficient technology. After more than 4 years, most of those barriers are still inhibiting innovation.

During consideration of the 1979 amendments to the Clean Water Act, the Congress recognized a reluctance among design engineers and communities to venture into relatively untried technologies that might yield better performance. The engineers and communities were concerned about potential performance problems and the risk of costly and politically embarrassing failures. The tendency to cling to the tried and true and to avoid risks was the order of the day in wastewater treatment design and construction.

The incentives in the innovative technology program were specifically structured to overcome these barriers. The 10-percent bonus was intended to encourage communities to try these new processes, and the modification and replacement guarantee was intended to protect the communities if an innovative process did not work as expected.

During our review of the 70 projects, we asked EPA and state I/A coordinators, project engineers, local government officials, and consulting engineers whether the incentives in the innovative program had succeeded in overcoming the barriers the Congress identified. In most instances, we were told the incentives were not sufficient to overcome the barriers. Consulting engineers, for example, stated that in most cases the incentives did not affect their selection of a treatment process or they cited other reasons for selecting the treatment process.

- Consulting engineers may not be receiving a fee large enough to compensate them for the risk and effort involved in designing an innovative project.
- Some states do not support the modification and replacement guarantee.
- State policies tend to create barriers to innovation.

INCENTIVES HAD LITTLE EFFECT ON PROCESS SELECTION

A primary reason cited by consulting engineers and communities for selecting a specific wastewater treatment process was that it was the most cost-effective. Other reasons included the ease of operation for the community, the need to stop using

chlorine for disinfection, a desire to save energy, and the availability of land. Only 13 (19 percent) of the 70 projects cited the 10-percent bonus and 3 (4 percent) cited the modification and replacement guarantee as the reason for selecting an innovative process.

The incentives in the innovative technology program were specifically designed to overcome barriers to innovation. The bonus is both a carrot and a stick. It is a carrot in that it provides extra funds to the community but a stick because it is paid out of a mandatory set aside from each state's construction grant allotment. Any funds in the set aside which are not obligated for innovative projects within 2 fiscal years are reallocated to other states.

Small communities with limited financial resources and low state priority for receiving grant funds were most frequently influenced by innovative program incentives. For example, in the Dallas region, consulting engineers for 9 of the 23 projects claimed the selection process was influenced by the 10-percent bonus. The nine projects included six communities with populations under 1,500 but only three communities with populations over 1,500 (the range was 4,000 to 115,000). None of the 23 consultants cited the modification and replacement guarantee as an incentive. In the Philadelphia region, consultants for 20 of the 24 projects said the selected process would have been chosen even without innovative incentives. Two of the 24 said the modification and replacement guarantee was an important factor in the decision. One said the 10-percent bonus was an important factor.

In those cases where the 10-percent bonus had an effect, the bonus often was overshadowed by other factors which influenced the decision. For example, El Paso, Texas, in 1975 planned to build a conventional treatment plant which would deliver over 5 million gallons per day of highly treated effluent to a local power-generating station for cooling. In late 1977 the plan fell through as the generating plant was scheduled for phasedown. The city was faced with finding an alternative for discharging its effluent. The city was also faced with water conservation and drinking water supply problems.

The city selected an innovative approach of injecting the highly treated wastewater into the Hueco Bolson Aquifer, which helped deal with all three concerns--wastewater discharge, water conservation, and water supply. Although city officials were aware of the innovative bonus, the overriding concern was the need to deal with the three water problems.

CONSULTANTS MAY NOT BE
ADEQUATELY REWARDED FOR
ACCEPTING EXTRA RISK AND EFFORT

In many projects we reviewed, the consulting engineer played the major role in selecting the wastewater treatment processes.

However, the consultant does not directly receive any of the 10-percent bonus, and if the project fails, the modification and replacement guarantee does little to repair possible damage to the consultant's reputation.

Consulting engineers told us that they generally select the treatment process for most communities. In a few cases the consultants worked jointly with city engineers or city engineers made the decision. In Region III, for example, consulting engineers told us they selected the treatment process for 19 of 24 projects. Of the remaining five projects, three were decided jointly, and two were selected by city engineers.

EPA's grant payments for an engineer's fee are based on the total cost of the project. This fee normally covers three elements--the number of hours worked, the salary rate of engineers working on the project, and profit. All three elements can be substantially affected by an innovative project. Where a consulting engineer is unfamiliar with a process, more senior engineers are likely to be involved than with a more familiar process. More time may also be required to learn about the process and to complete the design. In addition to extra direct costs, the consulting engineer is accepting greater risk and the chance of a failure which could damage his reputation. The engineer could also be held liable for the failure if the failure is caused by negligence, a somewhat greater possibility with an unfamiliar technology. Engineers frequently told us they would not accept the risk or cost of designing an innovative wastewater treatment plant without some additional compensation. Generally, consultants are not paid for their extra time or the risk in designing an innovative process.

The modification and replacement guarantee was intended as an added incentive for consultants and communities to take risks; however, it has not been successful because it does not change the relationship between the consultant and the municipality or lessen the risk of damage to the consultant's reputation. The concept of taking risk is not generally consistent with the basic relationship between the consultant and municipality. All cities receiving construction grants are faced with deadlines in the Clean Water Act for correcting pollution problems. Although the Clean Water Act requires applicants for federal grant assistance for the construction of wastewater treatment works to consider innovative and alternative technologies before selecting a process, EPA's national I/A coordinator said that the requirement to solve a difficult and costly problem in a limited period of time generally leads municipalities and consultants to solutions they know will work.

For the consultant and the municipality willing to take a risk on using an innovative process, the potential embarrassment of designing a facility which does not work is a significant factor. Consultants told us they depend on their reputations to obtain work. Being associated with a failed project, even though

EPA might replace it, would seriously harm their reputations. Most consultants told us they were unwilling to take that risk.

SOME STATES DO NOT SUPPORT
MODIFICATION AND REPLACEMENT
GUARANTEE

The modification and replacement guarantee has not proved effective as an innovative program incentive because of the uncertainty about whether it will be available if a community needs it. The basic problem with the guarantee, as explained by state I/A program coordinators, is that since there is no separate source of funds for the guarantee, funds must come from each state's basic allotment. To fund the same project twice would penalize other communities by taking away their grant funds.

In order for projects to receive funds, they must be placed in the funded portion of the state's priority list. Five of the 11 states in the 3 regions were reluctant or unwilling to place modification and replacement guarantees on the funded portion of the states priority list. Some states told us that they generally "play down" the guarantee or do not mention it to grantees unless asked. For example, Illinois state officials told us the state would not give grantees priority for funding a modification and replacement grant. A community requesting such a grant would be placed on the priority list with all other communities. The state stresses this to grantees and consulting engineers early in facility planning. As a result, Illinois state officials told us that they are very reluctant to recommend risky projects for innovative funding. Consulting engineers for the 11 Illinois projects we reviewed cited "most cost effective" as the reason for selecting an innovative process. They did not mention the innovative bonus or guarantee as reasons.

The remaining six states in our review support the modification and replacement guarantee, though we found only a few instances where the guarantee was cited as a reason for selecting an innovative process. The importance of the modification and replacement guarantee is further demonstrated in the case of Montrose, Colorado. The city selected a somewhat risky but potentially innovative wastewater treatment process but switched to a conventional process when the state informed it that modification and replacement funds might not be available. The process, known as vertical tube reactor, uses chemical oxidation and high pressure in a 6,000 foot deep well to create temperatures in excess of 450° fahrenheit which incinerates most of the sludge. Although it is costly to drill a well of the size and depth required for this project, it offers potential savings in operation and maintenance and energy costs and would produce less sludge than a comparable conventional treatment plant. However, without the modification and replacement guarantee, the city was not willing to take the risk.

SOME STATE POLICIES DO NOT ENCOURAGE NEW TECHNOLOGIES

The intent of the innovative program is to encourage communities and consulting engineers to depart from traditional wastewater treatment practice. State policies in some instances can hinder the acceptance of innovative processes by adding treatment processes or requiring very conservative treatment practices, as well as raise the cost of the innovative process and reduce the intended benefit to the community.

An example of added treatment processes which can affect acceptance of innovative projects involves the overland flow system. This innovative process, which applies untreated wastewater to the land, is contrary to accepted environmental practices and frequently draws protests from state health departments and the public at large. Experience in the food processing industry and in Europe shows that screened, but otherwise untreated, wastewater applied to an overland flow system has excellent potential for meeting required treatment levels for most communities.

Louisiana and Arkansas have policies which could adversely affect use of overland flow projects. The Arkansas state I/A coordinator told us he had problems early in the program because the State Department of Health opposed the direct application of wastewater to the land. In order to get such projects approved, he agreed to a compromise which required oxidation ponds--a conventional form of wastewater treatment--as additional first stage treatment in an overland flow system. Three overland flow projects in Arkansas have been affected by this requirement for additional treatment.

An example of conservative treatment practices is demonstrated in Louisiana. The State Department of Health has affected overland flow projects by requiring communities to apply wastewater at very low rates, which requires more land to treat a given wastewater flow. Before 1981 the health department required overland flow systems to apply wastewater at no more than 2 inches per week. Later this requirement was changed to 4 inches per week, in effect cutting in half the amount of land required. Four inches is still a fairly conservative standard compared to the 6 to 16 inches per week recommended by EPA.

In Illinois we found similar conservative treatment practices which prevented small communities from considering innovative processes. State I/A program officials told us the only technology they will approve for a community with a population under 2,500 is a lagoon--a conventional process. The reason they cited for this restriction was to ensure that small communities construct wastewater treatment systems which are low in cost and simple to operate. They said most small communities in Illinois do not have the resources or capability to operate more sophisticated facilities. While these conservative practices are a result of reasonable goals, they can prevent consulting engineers from considering innovative processes which could meet the same goals.

A TARGETED DEMONSTRATION PROGRAM
COULD HELP OVERCOME BARRIERS

One solution to help overcome some of the barriers and allow funding of more innovative projects is a targeted demonstration program. This program was endorsed by several EPA and state grant program officials. The demonstration program would allow EPA to select promising technologies, solicit communities willing to accept such technologies, provide up to 100 percent federal grants directly to communities to fund construction, as well as start-up costs, and evaluate operations and results of the projects. The demonstration funds could also be used to modify or replace any demonstration facility which does not meet design performance specifications where such failure significantly degrades plant performance or increases capital or operation and maintenance expenditures.

The innovative technology program depends on its incentives to influence a number of factors which will result in an innovative project. Some of those factors are motivation of the consulting engineers, state policies, support from state reviewing officials, and a match between community needs and potential innovative processes.

Consulting engineers, communities, and state officials told us that they are still not strongly influenced by the incentives to take risks in designing and constructing wastewater treatment plants. Consequently, there are a number of promising technologies which have not been accepted by the engineering community or by the states. The Director of the Cincinnati Municipal Environmental Research Laboratory, the Director of EPA's Waste Management Division, and an environmental engineer in the technical support group identified six technologies which offer significant potential benefits but have not been funded under the innovative technology program. Each of these technologies contains risk which could be reduced through a demonstration program, and make the technologies more attractive to engineers, states, and communities. Even after being demonstrated, these technologies would most likely qualify as innovative processes because they would not have been fully proven under all circumstances of intended use.

For example, the Captor process, which was developed in England, upgrades a conventional activated sludge process. It uses foam sponges as a medium in which microorganisms can grow. The sponges have such a large surface area for growing the microorganisms that the size of the plant can be reduced, and treatment occurs more efficiently. An environmental engineer in EPA's technical support group estimated savings of 20 percent in capital and energy costs with this system. The system is risky, however, since little performance data are available. A mechanism to remove and clean the sponges is needed, and the design approach is uncertain. It is not known how many sponges will be needed nor how long the sponges will last--both major factors in the effectiveness of this technology. This process has significant potential benefits but needs to be demonstrated on a full-scale basis.

A formal demonstration and evaluation program could also benefit biological aerated filter technology. The biological aerated filter which is described on pages 5 and 6 was pilot-tested in Salt Lake City before being approved under the innovative program. The pilot plant revealed significant mechanical, operational, and design problems. The filter became plugged with dust, the filter backwash did not operate properly, and holes in the aeration pipes were too small. Each of these problems prevented the plant from operating properly and involved costly repairs. Since this plant was operated in a demonstration mode--with a range of design and operating variables, the defects could more easily be identified and corrected. If the plant had been constructed under the innovative program without the demonstration experience, the design problems might not have been discovered and the cost of making repairs could have been very expensive.

EPA's national I/A coordinator told us he would like to see a targeted demonstration program administered jointly by EPA's Office of Water Program Operations (which administers the innovative technology program), EPA's Office of Research and Development, and the states. Further advantages of a demonstration program, according to the national I/A coordinator, are:

- The number of technologies which could qualify as innovative could increase, thereby making it easier for states to spend their set-aside funds.
- The risk in these innovative projects would decrease because of the additional evaluation and information generated by the demonstrations. With less risk the consulting engineers would be more likely to accept these improved processes.
- The need for and importance of the modification and replacement guarantee would be diminished for the demonstrated projects because of the reduced risk. Also, risk to the consulting engineers and local officials would be lessened because of the identification as a demonstration project and the sharing of responsibility with EPA and state officials. EPA could also provide grants for up to 100 percent of the cost of needed modifications to the demonstration plant.

The Clean Water Act contains provisions for a research and development demonstration program. Although this provision could be used to undertake such a demonstration program, no funds have been appropriated for the program since fiscal year 1975 because such a demonstration program was not attractive to municipalities. The research and evaluation requirements of the program would raise the costs of the projects, yet the level of reimbursement (75 percent) is the same as a regular construction grant and is 10-percent lower than for the innovative technology program (85 percent).

CONCLUSIONS

The primary incentives in the innovative program, the 10-percent bonus and 100-percent modification and replacement guarantee, have not had much effect on the selection of treatment processes. Only 13 of the 70 grantees cited the bonus as an incentive, and 4 of the 70 cited the modification and replacement guarantee as an incentive.

Also present, but not always evident in these decisions, were a number of barriers which tended to offset the incentives. For example, the larger communities were less likely to be influenced by the bonus than the smaller communities which could not have afforded any wastewater treatment plants without the 10-percent bonus. The modification and replacement guarantee on the other hand had little effect on the projects in our sample. The primary reasons cited were a lack of confidence that the guarantee would be available and the fact that the guarantee does not deal with the factor of embarrassment to the design engineer associated with a failed project.

The states have also contributed to the barriers by continuing to apply very conservative standards which raise the cost and effort required to successfully construct an innovative project.

A targeted demonstration program would help overcome some of these still existing barriers. Such a program would allow EPA to select and to provide up to 100 percent federal grants directly to communities to fund promising technologies rather than depend on the states to propose innovative processes.

AGENCY COMMENTS AND OUR EVALUATION

In our draft report we suggested that the Administrator, EPA, determine whether a targeted demonstration program should be established and that, if EPA decided to set up such the program, it should seek legislative changes to designate a portion of the innovative program funds for the demonstration program.

EPA commented that the concept of a targeted demonstration program had merit for a number of reasons: the perceived risk would decrease; the program would evaluate innovative technology performances and be a dependable source of adding innovative processes to the marketplace; and the program would encourage private sector participation and provide added incentive to encourage municipalities to adopt new or more innovative technologies under the construction grant program.

EPA said, however, that it would oppose funding the demonstration program from the construction grant appropriation because the grant program (1) places primary risk on grant applicants and their consultants and (2) is already taxed with multiple reserve programs such as the I/A program, a small community set aside program, and an advance program for planning in smaller communities.

RECOMMENDATION

We recommend that the Administrator, EPA, establish a targeted demonstration program for potential innovative technologies. In view of EPA's agreement with the concept of a targeted demonstration program but opposition to funding the program from construction grant funds, EPA should examine the possibility of using funds from other EPA programs or, if funds are not available, EPA should prepare a justification for additional funds and provide such information to the appropriate congressional committees for their consideration.

INNOVATIVE TECHNOLOGY PROJECTSRegion III

<u>Name</u>	<u>State</u>	<u>Size (MGD)</u>	<u>Population served</u>	<u>Type of innovative project</u>
Thurmont	MD	1.000	6,900	Ultra violet disinfection
Hagerstown	MD	8.000	35,000	Thermophylic digestion/hybrid poplars
Popular Hill	MD	0.016	200	Subsurface soil absorption field
Baltimore	MD	170.000	1,385,000	Waste pickle liquor
Smithburg	MD	0.200	680	Ultra violet disinfection
Oakland	MD	0.900	3,400	Plastic biofilter/diffused aeration
Maryland City	MD	N/A	N/A	Process not selected
Clear Spring	MD	.200	N/A	Ultra violet disinfection
Philadelphia	PA	N/A	N/A	Eco-rock co disposal
Hallstead	PA	0.350	4,196	Oxidation ditch/draft tube
Berrysburg	PA	0.030	450	Sanilological activated sludge
Lancaster	PA	30.000	138,637	Anoxic-oxic
Mount Holly Spring	PA	0.300	3,500	Low load aeration (dutch carrousel)
Craigsville	VA	0.250	1,500	Slow rate irrigation/land application
Smithfield	VA	0.050	4,500	Oxidation ditch
Keysville	VA	0.030	1,787	Oxidation ditch/draft tube
Chatham	VA	0.450	2,284	Oxidation ditch/
Craig-New Castle	VA	0.175	1,740	Aquaculture
Grottoes	VA	0.200	1,214	Deep lagoon/u tube aerator/decantor
Boydton	VA	0.145	1,450	Activated sludge
Southampton/Cortland	VA	0.300	2,705	Oxidation ditch
King George County	VA	0.050	800	Oxidation ditch/dual clarifiers
South Hill	VA	1.000	4,450	Oxidation ditch/draft tube
Crab Orchard	WV	1.000	3,000	Oxidation ditch/draft tube aeration

N/A - not available

INNOVATIVE TECHNOLOGY PROJECTSRegion V

<u>Project name</u>	<u>State</u>	<u>Size (MGD)</u>	<u>Population served</u>	<u>Type of innovative project</u>
Albany	MN	0.400	2,400	Adding and mixing alum using a motorboat
Albert Lea	MN	3.400	34,450	Ultra violet disinfection
Eveleth	MN	1.700	7,500	Dyna-sand filters
Kenneth	MN	0.010	110	Septic tanks, collection sys., drain field
Knife River	MN	0.040	484	Ultra violet disinfection
Moorhead	MN	6.000	48,800	Ozone disinfection
North Field	MN	2.500	18,000	Ultra violet disinfection
Pine River	MN	0.200	1,986	Solar heating of buildings
Rochester ^a	MN	19.100	106,330	Phostrip
Rochester	MN	19.000	106,330	Energy recovery system
W Lke Superior	MN	43.900	130,000	Chemical air scrubber
Redwood Falls	MN	0.700	6,500	Fixed growth biological system
Elsah	IL	0.050	700	Equalization basin, RBC units, etc.
Gilman	IL	0.500	3,300	Vacuum assisted sludge drying beds
Grant Park	IL	0.300	1,300	Single cell lagoon w/ dual sand filters
Hanover	IL	0.100	1,400	Single cell lagoon w/ dual sand filters
Hoyleton	IL	0.050	470	Single cell lagoon w/ dual sand filters
Peoria	IL	N/A	100,000	Storage basins, control & monitoring fac.
P Durocher	IL	0.060	670	Single cell lagoon w/ dual sand filters
Sauget	IL	27.000	103,200	Activated carbon/wet-air oxidation
St Elmo	IL	0.300	2,020	Single cell lagoon w/dual sand filters
Tamms	IL	0.080	815	Single cell lagoon w/dual sand filters
Mill Shoals	IL	0.040	543	Single cell lagoon w/dual sand filters

^aThis project included two separate innovative processes and each received an innovative grant. We considered both processes as separate projects in this report.

INNOVATIVE TECHNOLOGY PROJECTSRegion VI

<u>Name</u>	<u>State</u>	<u>Size (MGD)</u>	<u>Population served</u>	<u>Type of innovative technology</u>
Lamar	AR	.106	789	Overland flow
Oppelo	AR	.142	900	Overland flow
Paragould	AR	2.200	15,214	Aquaculture
Wabbaseka	AR	.104	1,214	Overland flow
Wilton	AR	.090	940	Aquaculture
Arcadia	LA	.515	4,000	Overland flow
Castor	La	.030	298	Overland flow
Estherwood	LA	.080	1,000	
Forest Hill	LA	.056	700	Overland flow
Hall Summit	LA	.056	700	Overland flow
Jackson	LA	.753	6,040	U tube aeration/dynamic clarifer
Morse	LA	.088	1,100	Overland flow
Natchitoches	LA	6.500	28,360	Intrachannel clarifier
Vinton	LA	.920	7,591	Overland flow
W. Monroe	LA	5.630	33,354	Slow rock filter and hydrographic release
Santa Fe	NM	6.500	84,500	Draft tube aerated oxidation ditch
Choctaw	OK	.500	6,200	Sequencing cycled batch system
Heavener	OK	.450	3,300	Overland flow
Marietta	OK	.310	3,100	Ultra violet disinfection
Tulsa	OK	11.000	238,837	Waste heat recovery for anaerobic digesters
Austin	TX	26.000	209,000	Greenhouse for water hyacinth pond
Corsicana	TX	1.000	29,800	Overland flow
El Paso	TX	10.000	115,000	Aquifer recharge



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

27 SEP 1983

OFFICE OF
POLICY AND RESOURCE MANAGEMENT

Mr. J. Dexter Peach
Director
Resources, Community and
Economic Development Division
U.S. General Accounting Office
Washington D.C. 20548

Dear Mr. Peach:

The Environmental Protection Agency (EPA) has reviewed the General Accounting Office (GAO) draft report "The Innovative Technology Program: Reasons For Its Limited Progress" (GAO/RCED-83-220). As you are aware, Public Law 96-226 requires that the Agency comment on the draft report. Below are our general comments and our responses to the recommendations posed in the report for your consideration. Enclosed are detailed comments provided by EPA Regions III and V with reference to specific passages of the draft report which support our general comments and responses.

We believe the final report should clearly state that the innovative program is only a portion of the innovative and alternative technology (I/A) program under the Construction Grant program. As we understand, GAO originally intended to evaluate the entire I/A program, although GAO later decided to investigate only the innovative part. We assume that GAO believes the alternative portion is managed satisfactorily.

The report fails to indicate the value of the 200 projects designated as innovative. These projects involved new technologies that reduced total life-cycle costs by approximately \$200 million.

The draft report criticizes the Regions (primarily Regions III and V) for failure to properly assess "risk" in making the determinations whether a project is innovative. It is significant to the report's findings that GAO recognize that overall risk includes both "technical risk" and "institutional risk". "Technical risk" is based on a scientific and engineering analysis of the proposal which may include a review of research and demonstration studies and the results from the same or similar

-2-

innovations already tried elsewhere. A technical support group (TSG) focuses primarily on technical risk and attempts to determine whether or not the innovation being considered has a reasonable chance of performing as proposed. "Institutional risk" is less objective and is characterized by: the reluctance of engineers to try new technologies because of possible damage to their professional reputations if the project were to fail to perform as proposed; the reluctance of State agencies to approve the first installation of a new technology in their State; and the reluctance to spend public funds, whether Federal grant or local funds, for technologies where there may be a substantial degree of technical risk. The I/A program was intended to address both kinds of risk so it is not unusual that GAO found that some projects were funded even though they apparently failed to meet technical risk criteria considered by TSG. Further, GAO should recognize that the construction grant regulations specifically allow a project to be designated innovative even though the same or similar innovations may have been tried successfully at several other locations.

The GAO report does not consider that the recommendations of TSG are one of several factors that enter the approving/funding decision. It should be clear from the above discussion that the designation of a project as innovative involves a large amount of judgment and it is important that the project file clearly documents the basis for the funding decision and how TSG recommendations were taken into account. As reflected in the attached Regional Office responses, there were cases where project files did not fully document the basis for the decision. We do not believe, however, that this lack of full documentation is clear evidence to support the conclusion that decisions did not comply with Agency policy and guidance.

Below are the draft report's recommendations with accompanying EPA responses. We believe that all recommendations pertaining to actions of the Regional Administrators should indicate that these actions could be carried out by States acting under delegation agreements.

GAO Recommendation

GAO recommends that the Administrator, EPA, direct Regional Administrators to independently verify that all proposed innovative projects are thoroughly and systematically evaluated for risk and benefit in accordance with EPA regulations, including projects proposed under regional discretion authority.

EPA Response

We agree with this recommendation.

-3-

GAO Recommendation

GAO recommends that the Administrator, EPA, direct Regional Administrators to send all innovative project requests to the Cincinnati technical support group for review. Unless actions to the contrary are appropriately justified, the Regions should be required to follow the support group's recommendations.

EPA Response

EPA disagrees with the recommendation to send all projects to TSG for review. EPA is delegating responsibility for managing the construction grants program to the States. In carrying out this theme, there is no reason not to delegate I/A project decisions to the States as long as the bases of decisions are sound, consistent with the regulations and documented in the project files. EPA intends to maintain TSG in its established role for providing technical assistance on the more difficult projects.

The Office of Water Program Operations' Program Operations Memorandum (POM) 79-3, dated May 30, 1979, established TSG at the EPA research facility as a central point for technical expertise. The POM does require that a review be performed and encourages that these reviews be performed at the State or Regional level, but gives the Region the option to send all innovative projects to TSG for supporting technical review.

GAO Recommendation

GAO recommends that the Administrator, EPA, direct Regional Administrators to provide a written explanation of the basis for each innovative decision including the evaluation of risk and potential benefits and actions taken on technical support group's recommendations.

EPA Response

We agree that project files should document the basis for innovative decisions and specifically address recommendations of the State, Region or TSG that were not followed. The Regions included in this study have already initiated actions to implement this recommendation.

-4-

GAO Recommendation

GAO recommends that the Administrator, EPA, determine whether a targeted demonstration program should be established. If EPA decides to set up such a program, EPA should seek legislative changes to designate a portion of the innovative program funds for the demonstration program.

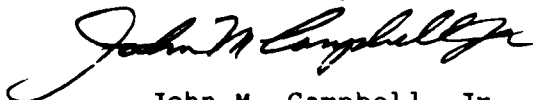
EPA Response

EPA agrees that many barriers to innovation still exist within the Construction Grant program as outlined in Chapter 3 of the report. EPA believes that the concept of a "targeted demonstration program" has merit.

We concur with GAO that the perceived risk would decrease by a demonstration program. This program would evaluate performances of innovative technologies and would also provide a dependable source for adding innovative processes to the marketplace. Private sector participation in a demonstration (evaluation) program would be essential and would provide added incentive to encourage municipalities to adopt newer or more innovative technologies as a normal part of the Construction Grant program. However, EPA would oppose funding this demonstration program from any portion of the Construction Grant appropriation. Funding through this grant program continues placing the primary risk on grant applicants and their consultants. This program is already highly taxed with multiple reserves: I/A, small communities and advances to cover costs for planning of smaller communities.

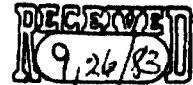
We appreciate the opportunity to provide comments on this draft report and hope that this letter will prove beneficial during preparation of the final report.

Sincerely yours,



John M. Campbell, Jr.
Acting Associate Administrator
for Policy and Resource Management

Enclosures



GAO I/A Response-TPE/Crampton...(LM).....9/2/83...5 page
GAO Draft Report, "The Innovative Technology
Program: Reasons for Its Limited Progress"

Thomas P. Eichler
Regional Administrator (3RA00)

Lewis S. W. Crampton, Director
Office of Management Systems and Evaluation (PM-222)

Thank you for your August 25, 1983 memo in which you provided the Region with an opportunity to respond to the referenced report. Attached are detailed comments as provided by my staff. I trust that they will be of service in the preparation of the Agency response.

The GAO report recommended a number of procedural changes which have already been implemented. We will of course continue to work with you to further improve our management of the Innovative Technology program.

If I or my staff can be of any further assistance, please let us know.

Enclosure

1. The "Cover Summary" Conclusions

The report states that "project engineers...did not follow Agency regulations and advice on project eligibility." That statement is misleading because regulations were followed and advice [from the Technical Support Group (TSG)] must be considered, but no policy exists to require Regional action based strictly on that advice.

[GAO Comment: We do not agree that the regulations were followed (see regional comment #2). We have changed the cover summary concerning the technical support group advice.]

2. Adherence to Innovative Criteria (page 11, 11)

We disagree with the statement in the report that reads our office "frequently did not adhere to the criteria." To the best of our knowledge, our projects have met the criteria. An important point to note however is that the criteria, particularly the "risk" criteria, are highly subjective. A judgement on a particular technology can be expected to differ given different reviewers, points in time, and individual project application.

It is, in our minds, unsupportable for a report such as the GAO study to make such a clear cut statement on such a judgemental area.

We also feel that in some cases GAO simply was not provided with documents which showed compliance with the Innovative criteria. In some cases, we were unable to quickly locate documentation of all actions. A large portion of those actions however occurred years ago, and sometimes by staff who are no longer with the Agency. This problem, while not programmatically acceptable, can easily relate more to staff time availability over the years than to improper grant decisions.

[GAO Comment: In reviewing the projects approved by the Philadelphia region, we examined all project files in the region and state environmental offices for any correspondence or documents which would show that the projects were technologically innovative. We also interviewed the current, or where available, the previous project engineer to obtain an explanation of the information in the file. We also interviewed state and local officials, the consulting engineer and the I/A coordinator concerning the justification for each project. At the completion of our review work, we again met with the I/A coordinator and project engineers in Philadelphia and reviewed each project to assure our conclusions were correct. We explained how we categorized each project and what we based our conclusion on. In all cases the I/A coordinator and project engineers agreed with our assessment of the projects. Since the Philadelphia response does not provide any additional information to show how the projects were innovative, we have not changed our conclusions.]

3. I/A Procedures (page ii, 11, 12)

It is true that our I/A procedure paper was not distributed until November 1982. That fact however does not of itself identify a problem, since a great many elements of the CG program do not have guidance beyond that contained in the regulations.

The report also states that "project reviewers were generally unfamiliar with the Innovative criteria and did not consistently follow it." Some project managers interviewed by GAO were not familiar with the program. Some of them however were not the reviewer at the time of the relevant grant actions. Also, some of them relied exclusively on the I/A Coordinator for I/A reviews. In all cases, project manager's supervisors were familiar with program requirements, and it is at that level that problems were resolved when the project manager was unable to address it individually. By no means should it be inferred that reviews by project managers, complete or otherwise, represent final Regional decisions.

[GAO Comment: Our report points out on pages 11 and 12 how the Philadelphia review process works, and shows the roles of the project engineers, the I/A coordinator, and regional director of the water division. We concentrated our attention on how well project engineers performed their functions because they have the principal responsibility for assuring that the projects have sufficient justification for meeting the innovative criteria.]

4. Barriers to Innovation (page iii, 22, 23, 24, 26)

A great deal of technological inertia existed in the wastewater management profession in 1977, and it should come as a surprise to no one that much of it remains. The GAO report implies that little or no headway has been made in that effort however, and with that we disagree.

The typical Facility Planning effort today is developed by an engineering firm aware of program requirements, and it is reviewed by State and EPA staff who encourage I/A project development. Such was not the case only two to three years ago.

In some cases, supplemental funding was granted for projects that would have proceeded without it. There are however no restrictions in the Act or the regulations to prevent such funding, and we do not feel that it was improper. Communities should be rewarded for innovation where allowable even if the reason for their action is not solely based on the program.

The GAO report accurately describes some of the reasons why the engineering profession has been slow to encourage I/A. In addition to the issues of "fees" and "risk," we would also however include the development of architectural/engineering (A/E) expertise in I/A. Many firms were simply not familiar with the new technologies.

A major difference between this issue and the other two should also be noted; A/E expertise on I/A issues is increasing, and that trend will continue.

See GAO note on p. 49.

We agree that the modify/replace (M/R) guarantee has not served to substantially increase I/A technology use. The main reason for this is its inherent unreliability, as explained in the report.

Our suggestion is that the Act be amended to provide M/R funding out of unallocated I/A funds rather than from State allotments. This would serve as a reliable source which would not reduce a state's available funding.

[GAO Comment: We agree that some progress has been made in overcoming some of the barriers. But the preponderance of evidence we obtained from consulting engineers and states shows that the barriers still exist and the innovative program has had little impact.

[The region's suggestion that the modification and replacement funds be provided from unallocated funds may have merit and should be pursued by EPA headquarters.]

5. Targeted Demonstration Program (page iv, 27)

GAO proposed that the Act be amended to allow EPA to fund demonstration projects. We agree that such an effort would be a positive step, but would add some thoughts on its funding source and on its intent.

Such a program should be funded with 100% I/A funds. If it requires a large "basic" match, some States would be unable to take advantage of it for the same reason that they have had difficulty using their regular Innovative funds. The reason for this is that States like Pennsylvania have allocated much of their basic funds to large conventional metropolitan projects. There simply is not enough basic funding left to use the supplemental I/A.

The intent of the demonstration should also not be over-extended. It would assist in spreading heretofore underused technologies. It would not however address the many other areas of the program in which we have much work to do.

[GAO Comment: The region's comment on the targeted demonstration concept closely parallel EPA's comments, which we have included on page 29.]

6. Recently Completed Reviews

The reviews of some Innovative projects were completed after GAO completed its interviews; the following is therefore provided to allow GAO to update its files.

The Hagerstown, Maryland review was completed July 11, 1983. The conclusion was that the system is Innovative. Similarly, the Oakland, Maryland review was completed April 8, 1983. That project was also determined to be Innovative. A copy of our review documentation is available on request.

Other proposed changes include elimination of Innovative funding for MES-Poplar Hill, Maryland (where a different technology was selected), for Grottoes, Virginia (also where the process changed), and for Maryland City, Maryland (where funding was premature). This new information on Grottoes should affect the Report (page 14) narrative.

[GAO Comment: We noted these changes in the report on page 12. We did not change our table on page 8 because this data reflects the region's initial funding decision.]

7. Region III Efforts to Improve Program Management (page 12)

As the report states, we have made efforts to improve our management of the program. Indicators of that effort include the development of an informal I/A team in which we use available Regional expertise to assist the I/A Coordinator. Of note also is the fact that we rejected ten proposals for Innovative funding over the past year, primarily due to insufficient risk.

It could also be noted that our efforts were begun before the GAO review was initiated. Our procedural manual was for instance finalized in November 1982.

Staff time limits, also referenced in the report, continue to be a problem. To the maximum extent possible though we will continue to promote new technologies and to carefully distribute funds to worthy projects.

[GAO Comment: The I/A coordinator gave us memorandums which stated the region made significant changes to its procedural manual as a direct result of information we provided to the region during our preliminary discussions with the region in December 1982. Further, as a result of the December 1982 meeting, the I/A coordinator was directed to spend more time on the innovative program. The coordinator then initiated a training program for regional project engineers and branch chiefs.]

8. TSG Advice and "First-in-State" Risk Issue (pages 8, 14, 16, 17, 19, 25)

The GAO report commits an error, in our opinion, by equating the TSG opinion on the "First-in-State" issue with National policy. TSG serves as a highly valued support group, but we consider their opinions as being subject to National and Regional policy. We have therefore not "ignored" TSG advice. We have however chosen at times to reject it based on Regional policy.

In our opinion, the first use of a technology in a State positively impacts the risk analysis. To fail to recognize this issue is to lose sight of some of the major problems affecting new technology use.

States generally feel responsible to their constituents first to protect public health, secondly to provide long-term reliable pollution control, and perhaps thirdly to select cost-effective (perhaps innovative) treatment. Given the risk inherent in Innovative projects, we must recognize an inevitable conflict with the first two responsibilities, and that conservative wastewater treatment is the common tendency.

Given these realities of life, to fail to offer the Innovative program incentives to a State because a nearby State employs that system will perhaps eliminate the potential for its use.

We feel therefore that the fact that a technology has not been used yet in a State should not absolutely decide its risk status, but that it should play an important role.

Please also note that early verbal guidance from EPA Headquarters clearly indicated that the first time a technology was used in a State it would be Innovative.

[GAO Comment: We have discussed EPA's comments on the technical support group on page 20 of the report.]

[We do not agree that the first time a technology is used in a state necessarily constitutes "technological risk". Additionally, the issue of "first-in-state" is not addressed in EPA's regulations or in Philadelphia's regional policy. If a technology such as an oxidation ditch, has been used successfully in numerous states under the same expected climatic conditions, it is difficult to understand why it would qualify as technologically risky (see pages 8 and 9).]

9. "Projects Did Not Meet Risk Criteria" (pages 8, 9)

The GAO report discusses the use of ultraviolet disinfection (UV) at 3 plants in the State of Maryland. It also quotes our I/A Coordinator as saying that there is little risk of failure at those facilities. Further explanation of that statement is in order.

We believe that given today's state-of-the-art, UV is likely to be Innovative only in unusual cases (such as with high suspended solids in the effluent). The referenced statement refers to this current condition.

This does not mean however that those past determinations were in error. The technology has improved greatly in the past several years, and there are many more facilities to refer to. We feel those decisions, when made, were correct.

[GAO Comment: When we discussed the three ultraviolet projects with the I/A coordinator at the completion of our work, he agreed that there was no risk in these projects and they should not have been approved as innovative.]

[The regional comments indicate that the decision on the three projects were correct, that is, they met the eligibility criteria. The region stated that the projects would have qualified as innovative if they had high suspended solids in the effluent, but the region did not provide additional information to show that this was the case for these three projects.]

10. Reviews by TSG (page 18)

As we have stated previously, we value the service that TSG is available to provide. We do not agree however that all projects should be sent there, as the report recommends.

We are developing a team of experts in the Region who can perform the same type of review on typical projects as would TSG. We intend to continue to consult TSG, particularly on unusual projects, but have found that given current TSG resources, reviews can take excessive time.

Regardless of where the technical reviews are completed, we feel that it is a series of other problems that most hinder complete success of I/A. Some of them were discussed on page iii of the report, and in our comments above. It is these problems that deserve our full attention.

[GAO Comment: We discuss this matter on pages 6, 7, and 20. It is our view that while the regional office could develop more technical expertise, it would not have available the team of experts and the research that is now available in Cincinnati.]

[We have no indication that the technical support group reviews took excessive time. The reviews generally took no more than two weeks.]



To: L.CRAMPION (EPA2160)
Cc: F.EIDNESS (EPA4000)
Cc: MDSD (EPA4331)
From: C.SUTFIN (EPA9560) Posted: Wed 14-Sep-83 13:05 Sys 63 (273)
Subject: GAO Report on Innovative Technology Program
Acknowledgment Sent

Innovative Technology Program
September 14, 1983

Review Comments on GAO Draft Report "The Innovative Technology Program:
"Reasons for Its Limited Progress"

Alan Levin
Acting Regional Administrator

Lewis S.W. Crampton, Director
Office of Management Systems and Evaluation (PM-222)

We have reviewed the subject report and would like to make some comments. The report was not specific as to the individual project details upon which the report conclusions were based. Therefore, we have included the attached table which summarizes the justifications which support the innovative designation on each project. Every project was reviewed, and subsequently designated in accordance with the existing regulations and guidance. As indicated on the table, eleven out of the fifteen different technologies represented in this table, I/A Technical Support Group (TSG) recommendations were requested by the Region. On three additional technologies (U.V., Solar, Sludgebeds) innovative designation precedents had already been set in other Regions. Nine out of the eleven TSG reviews contained specific technical recommendations, and out of these nine, six supported designation as innovative technology (including EPA-HQ recommendations). In the remaining three instances the Region designated projects as innovative, analyzing and documenting in our review the differences between TSG and Region V analysis.

[GAO Comment: The table (see page 50) provided by the regional office reiterates the funding decisions the region made for the 23 projects. Our conclusions about the 23 projects are shown on page 8 which shows that five appeared to be technologically innovative, 12 were questionable, and six could not be assessed. Page 15 shows that TSG reviews covered 15 of the 23 projects and that TSG recommended denial of 12 projects and approval of three projects. The number of projects the region considered technologically innovative differ significantly from our numbers. The region provided no additional information supporting its determinations.]

1. Risk Assessment

The intent of Congress in establishing the Innovative Technology Program was to encourage the use of "new" (not fully proven) and "better" (cost, energy and environmental benefits) technologies. The subsequent September 27, 1978 Regulations and guidance document MCD-53 (I/A Technology Assessment Manual) further define categorization of a technology as innovative by expanding on these definitions. Technologies were to be considered "new" if they were developed methods which had not been fully proven under the circumstances of their intended use. Inherent in the definition of not fully proven technology is a recognition that risk exists, and that risk must be commensurate with proposed benefits. Nowhere in the Regulations or guidance is risk presented as a separate criterion, but risk is presented only as one of the components of defining "not fully proven technologies". As part of the definition of innovative technology the Region routinely considers factors of risk in terms of the project specific application of the proposed technology.

To cite as one example, the report states (on Pages 12, 13) that Region V ignored risk and various risk factors such as climate with regard to seven projects in Illinois using lagoon technology. As can be seen from the attached Region V review memorandum concerning Hanover, Illinois, (the first project proposing this technology that we reviewed) the assessment of this technology "risk" was specifically addressed and judged to be "appropriate" in view of the significant life cycle cost savings. Factors such as climate, algal populations, and lagoon performance were also specifically addressed. Memoranda on the six additional Illinois projects using this technology reference the Hanover technology assessment. MCD-53 in section 2.2.2.3 provides guidance that moderate or low risk technology may be justified (as innovative) when high potential benefits are present. The potential benefits for the seven lagoon projects were life cycle cost savings ranging from 19 to 40 percent.

[GAO Comment: While the region correctly points out that risk is not a separate criterion but must be considered with other factors, our evaluation of the region's determinations showed that the region did not adequately consider technological risk in approving projects (see pages 12 and 13).

[For the Hanover, Illinois project, the region stated that factors such as climate, algal population and lagoon performance were specifically addressed. We noted that the state prepared an analysis which addressed some of these concerns, but the analysis was not adequate. For example, the state analysis stated that the use of the single lagoon followed by sand filters for biological oxygen demand and suspended solids removal was a new application in Illinois. The state also said the project had significant risk for the following reasons:

- The frequency of cleaning of the filter beds, which is a manual, labor intensive task, was not known.
- The cold climate of Illinois was an operational concern.
- The effluent quality from a single cell lagoon may adversely impact the sand filters.
- The algal cell size from a single cell lagoon versus a multicell lagoon was not known.

[EPA's technical support group reviewed the state's justification, including the above information and stated that the "unknowns and concerns" expressed by the state were answered by two EPA reports on the operation and maintenance of similar systems. The studies showed that the proposed process would effectively remove all algae, that winter and summer operating procedures were known, and that the studies showed that the quality of the wastewater had little impact on system operation. The technical support group also stated that the most important considerations for successfully operating the proposed system were proper operation and maintenance and operator training. The technical support group concluded that the information available about design and operation of the proposed system and the relatively low wastewater strength expected at Hanover, showed that the system did not present enough risk to qualify as innovative technology.]

[We do not believe that the region's information on the Hanover project overcomes the questions raised by the Cincinnati technical support group.]

2 Technical Support Group (MERL) Advice

The report states that the Technical Support Group (TSG) advice is frequently ignored in Region V. The semantics presume that TSG has a project specific decision role and the use of the word "ignore" simply is not true. Region V has consistently asked for and considered the recommendations from the TSG as advice in terms of technical assistance. As outlined in Construction Grants Program Operations Memorandum No. 79-3 and as reemphasized in Harold Cahill's November 4, 1980 memorandum to the Regions, the TSG makes recommendations only, and the final decision on a project is made by the Regions who must also analyze programmatic, geographic, and climatic considerations, as well as potential benefits of the proposed project. This has been the procedure that Region V has followed and whenever the decision was inconsistent with the "advice" recommendation, the written decision addressed the inconsistencies.

For example, the report states (on page 15) that the Region did not follow TSG's recommendations on the seven Illinois lagoon projects. The attached Region V review memo specifically addresses the TSG's comments and established the basis on which the Region's determination was made. Also, the report (on page 9) cites the TSG comments on Albany, Minnesota as being ignored by Region V. However, the attached file copy of the TSG memorandum contains the Headquarters' recommendation that the project be considered for innovative funding based upon Regional discretion, the position subsequently taken by Region V.

[GAO Comment: We have revised the report to show that the regions did not adequately document or explain the reasons for not following the technical support group's advice.

[With respect to the region's comments on the lagoon projects, our discussion on the Hanover, Illinois, project, which was a lagoon, provides our position (see point 1 above).

[For the Albany, Minnesota, project, we do not believe that the region adequately explained the reasons for not following technical support group's advice. The headquarters recommendation that the project be approved based on regional discretion is not reason to reject without adequate explanation the technical support group advice.]

3 Use of Regional Discretion

On page 17, the report incorrectly quotes our I/A coordinator. He did advise that Regional practice was to use discretion when a developed, yet not fully proven, technology was proposed which did not fully qualify under the 15 percent life cycle cost savings or 20 percent net energy savings criteria on a total project basis. The September 27, 1978 regulations required that the cost and energy criteria be addressed in terms of the total project. Thus, if a unit process achieved significant cost or energy savings over a conventional unit process, it may not have been able to achieve the required savings over the entire treatment plant. Hence, it could only be designated as innovative under regional discretion. As addressed above, guidance on the use of Regional discretion does allow innovative designation of low "risk" technologies if potential benefits are judged appropriately.

[GAO Comment: We agree that the life cycle cost and energy savings criteria must be met in order for a project to be approved under regional discretion. EPA's regulations and guidance require that innovative projects contain a demonstrated level of increased technological risk. Technological risk, however, is not an absolute factor which can be objectively measured. For this reason EPA's guidance provide that

under regional discretion risk may in some cases be judged somewhat more leniently for higher benefit projects. EPA's guidance, however, requires that there still be increased risk and that the regions fully document and quantify the technological advancement (including risk) and the achievable public benefit for lower risk projects. As explained on pages 15 and 16 projects approved under regional discretion in Region V appear to pose little, if any, technological risk and technological advancement and achievable public benefit were not documented or quantified.

4. Report Recommendations

We have no objection to the recommendation on Pages 18, 19, but do have reservations concerning the listed procedures. Specifically, we agree with the first procedure and although the body of the report suggests to the contrary, Region V has always met the thrust of the recommended procedure. However, we are reviewing the management controls and will redefine specific implementation procedures that address the inaccurate presumptions of Region V performance reflected in the report. The second procedure concerning the MERL Technical Support Group (TSG) would require a completely new role for TSG in the program, which we oppose. The TSG role has been and should continue to be one of providing technical assistance to the program managers whether it be Regional or State personnel. The extensive amount of delegation in the construction grant program makes the procedure of submitting all requests to and obtaining comments from TSG before decisions are made totally inappropriate. It is also contrary to the decentralization concepts of the Federal Government and would create a project specific decisionmaking authority that directly conflicts with EPA's objectives of delegating water media program responsibilities and authority. Consistent with the third procedure, we completely agree that the Regions and/or States should be held accountable whenever decisions are made that conflict with TSG technical advice, whether the advice is received prior to, or after, decisions are made. We fully support the recommendation on page 30 regarding establishment of a targeted demonstration program.

[GAO Comment: We commend the region for reviewing its management controls over project eligibility determination.]

[The regional position on the use of the technical support group is consistent with EPA headquarters and the Philadelphia region. Our views on this matter are shown on page 20.]

If you have any questions on these comments or the specifics of any project, please contact us.

/s/ by Alan Levin

[GAO note: Page references in this appendix which referred to our draft report were changed to reflect their location in this final report.]

Alan Levin

Attachments

cc: Rebecca Harmer, (WH-556) w/attachments
Richard Thomas, (WH-547) w/attachments

INNOVATION DESIGNATION SUMMARY

Project	Technology	TSG Recommendation	Region V Justification
Albany, MN	Lagoon insitu phosphorus treatment	Innovative (HQ)	15% life cycle cost (LCC) savings. Never used in US. No long term Canadian data.
Albert Lea, MN	UV disinfection	Not requested	Public/environmental benefits due to elimination of chlorine by products. Large (12 mgd) installation not proven.
Eveleth, MN	Continuous backwash tertiary sand filter	Innovative	15% LCC savings on unit process. No previous municipal installations.
Kenneth, MN	Seasonal groundwater control for on-site systems	Innovative	14% LCC savings. Not proven for multiple home systems.
Knife River, MN	UV disinfection	Not requested	15% LCC savings on unit process. Elimination of chlorine by products. Not proven on secondary effluent.
Moorehead, MN	Ozone disinfection	Not requested	15% LCC savings on unit process, not proven in a range of applications.
Northfield, MN	UV disinfection	Not requested	Elimination of chlorine by products, not proven on secondary effluent.
Pine River, MN	Solar heating	Not requested	Public benefits not conventionally used in municipal applications. 20% energy savings on unit process.

Rochester, MN	1. Phostrip 2. Energy Recovery	1. Innovative 2. Conventional	1. Not fully proven. 2. 32% energy reduction, unique elaborate system never used before.
W. Lake Superior, MN	Odor Control	No technical recommendation received	15% LCC savings on unit process basis.

-2-

Project	Technology	TSG Recommendation	Region V Justification
Redwood Falls, MN	Fixed growth biological system after a lagoon for nitrification	Not classified	Not fully proven in circumstances of its intended use.
Elsah, IL	RBC	Conventional	15% LCC savings. Unique combination/arrangement of process units. Unproven O&M concerns. Local aesthetic benefits.
Gilman, IL	Vacuum Assisted Sludge Drying Beds	Not requested	15% LCC savings on unit process - not fully proven in municipal use.
Hanover, IL	Single cell lagoon sand filters	Conventional (Hanover only reviewed)	15% LCC savings. Not proven under Illinois climatic conditions. No long term operating data for intended application.
Grant Park, IL	"	"	"
Hoyleton, IL	"	"	"
Prarie DuRocher, IL	"	"	"
St. Elmo, IL	"	"	"
Tanna, IL	"	"	"
Mill Shoals, IL	"	"	"
Peoria, IL	Combined Sewer Overflow Treatment	Innovative	15% LCC savings, unique combination of technologies

Sauget, IL

Powdered activated
carbon-activated
sludge

Innovative
(Review of
Kalamazoo, MI
and Bedford
Heights, OH)

10% LCC savings, not fully
proven technology.

(089200)

1

1

1

1

29129-

AN EQUAL OPPORTUNITY EMPLOYER

UNITED STATES
GENERAL ACCOUNTING OFFICE
WASHINGTON, D C 20548

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID
U S GENERAL ACCOUNTING OFFICE



THIRD CLASS