June 1980

Environmental Control Technology Activities of the Department of Energy in FY 1979

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Assistant Secretary for Environment
Division of Environmental Control Technology
Washington, D.C. 20545

June 1980

Environmental-Control- Technology Activities of the Department of Energy in FY 1979

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

leg

Printed in the United States of America

Available from

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

NTIS price codes

Printed Copy:	\$ 8.00
Microfiche Copy:	\$ 4.00

PREFACE

This survey, sponsored by the Environmental Control Technology Division (ECT) within the Office of the Assistant Secretary for Environment, presents the environmental control research, development, and demonstration (RD&D) activities carried out in FY 1979 by the Department of Energy. The environmental control activities for FY 1977 and FY 1978 (as compiled by the Environmental Control Technology Division) were presented in DOE/EV-0030, "Environmental Control Technology Activities of the Department of Energy in FY 1977," dated November 1977, and DOE/EV-0031, "Environmental Control Technology Activities of the Department of Energy in FY 1978," dated March 1979. This report is the third in this series of annual reports.

**THIS PAGE
WAS INTENTIONALLY
LEFT BLANK**

CONTENTS

	<u>Page</u>
I. BACKGROUND	1
II. PURPOSE AND SCOPE	2
III. SUMMARY	3
IV. RESULTS	28
Conservation	31
Fossil Energy	41
Nuclear Energy	52
Solar	56
Geothermal	62
Energy Research	66
Magnetic Fusion Energy	72
Office of Environment	75
V. BIBLIOGRAPHY	87
VI. GLOSSARY	89

FIGURES

<u>Figure</u>	<u>Page</u>
3-1 Distribution of Total DOE Environmental Control Activities Related to FY 1979 Funding by Energy Category	7
3-2 Distribution of Total DOE Environmental Control Activities Related to FY 1979 Funding by Administrative Office	8
3-3 Distribution of Environmental Control Technology Funding in the Conservation Energy Technology Program	10
3-4 Distribution of Environmental Control Technology Funding in the Fossil Energy Technology Program	12
3-5 Distribution of Environmental Control Technology Funding in the Coal Subprogram of Fossil Energy Technology	14
3-6 Distribution of Environmental Control Technology Funding in the Nuclear Energy Technology Program	16
3-7 Distribution of Environmental Control Technology Funding in the Solar Energy Technology Program	18
3-8 Distribution of Environmental Control Technology Funding in the Environment and Safety Program	23
3-9 Distribution of Environmental Control Technology Funding in the Overview and Assessment Subprogram	25
3-10 Distribution of Environmental Control Technology Funding in the Decontamination and Decommissioning Subprogram	27

TABLES

<u>Table</u>	<u>Page</u>
3-1 Total DOE Environmental Control Activities Funding Allocation	6
3-2 Funding for Environmental Control Activities Related to Conservation	9
3-3 Funding for Environmental Control Activities Related to Fossil Energy	11
3-4 Funding for Environmental Control Activities Related to Coal Program	13
3-5 Funding for Environmental Control Activities Related to Nuclear Energy	15
3-6 Funding for Environmental Control Activities Related to Solar Energy	17
3-7 Funding for Environmental Control Activities Related to Geothermal Energy	19
3-8 Funding for Environmental Control Activities Related to Supporting Research	20
3-9 Funding for Environmental Control Activities Related to Magnetic Fusion	21
3-10 Funding for Environmental Control Activities Related to Office of Environment	22
3-11 Overview and Assessment Breakdown of FY 1979 Funding Related to Environmental Control Activities.....	24
3-12 Decontamination and Decommissioning Breakdown of FY 1979 Funding Related to Environmental Control Activities	26
4-1 Criteria for Applicability to Environmental Control Technology	29
4-2 Projects With Environmental Control Aspects; Conservation and Solar Energy; Building and Community Systems.....	33

TABLES (Continued)

<u>Table</u>	<u>Page</u>
4-3 Projects With Environmental Control Aspects; Conservation and Solar Energy; Transportation.....	34
4-4 Projects With Environmental Control Aspects; Conservation and Solar Energy; Industrial Programs.....	36
4-5 Projects With Environmental Control Aspects; Energy Technology; Electric Energy Systems.....	37
4-6 Projects With Environmental Control Aspects; Energy Technology; Energy Storage Systems.....	38
4-7 Projects With Environmental Control Aspects; Energy Technology; Fossil - Liquefaction.....	42
4-8 Projects With Environmental Control Aspects; Energy Technology; Fossil - High-Btu Gasification.....	43
4-9 Projects With Environmental Control Aspects; Energy Technology; Fossil - Low-Btu Gasification.....	44
4-10 Projects With Environmental Control Aspects; Energy Technology; Fossil - Utilization.....	45
4-11 Projects With Environmental Control Aspects; Energy Technology; Fossil - Enhanced Oil Recovery.....	46
4-12 Projects With Environmental Control Aspects; Energy Technology; Fossil - Enhanced Gas Recovery.....	47
4-13 Projects With Environmental Control Aspects; Energy Technology; Fossil - Mining Research and Development...	48
4-14 Projects With Environmental Control Aspects; Energy Technology; Fossil - Oil Shale	49
4-15 Projects With Environmental Control Aspects; Energy Technology; Fossil - In Situ Coal Gasification	50
4-16 Projects with Environmental Control Aspects; Energy Technology; Fossil - Magnetohydrodynamics	51
4-17 Projects With Environmental Control Aspects; Energy Technology; Nuclear Energy	53

TABLES (Continued)

<u>Table</u>	<u>Page</u>
4-18 Projects With Environmental Control Aspects; Energy Technology; Waste Management	54
4-19 Projects With Environmental Control Aspects; Energy Technology; Biomass (Solar)	57
4-20 Projects With Environmental Control Aspects; Energy Technology; Solar Thermal.....	58
4-21 Projects With Environmental Control Aspects; Energy Technology; Photovoltaics (Solar).....	59
4-22 Projects With Environmental Control Aspects; Energy Technology; Wind Energy Conversion Systems (Solar).....	60
4-23 Projects With Environmental Control Aspects; Energy Technology; Ocean Thermal Energy Conversion (Solar)....	61
4-24 Projects With Environmental Control Aspects; Energy Technology; Geothermal Energy.....	63
4-25 Projects With Environmental Control Aspects; Energy Research; Basic Energy Sciences.....	67
4-26 Projects With Environmental Control Aspects; Energy Research; Satellite Power System.....	71
4-27 Projects With Environmental Control Aspects; Energy Technology; Magnetic Fusion Energy.....	73
4-28 Projects With Environmental Control Aspects; Environment; Environmental Control Technology.....	77

I. BACKGROUND

The Department of Energy (DOE) is responsible for the research, development, and demonstration (RD&D) of existing and emerging energy technologies and the promotion of energy conservation in the Nation. A significant part of that responsibility includes the balancing of energy development goals with environmental requirements to protect and enhance the Nation's general health, safety, and welfare. This necessitates the inclusion of environmental and safety controls as an integral part of energy systems RD&D to ensure that environmental effects are considered and mitigating measures are taken as required.

The Environmental Control Technology Division (ECT) under the Assistant Secretary for Environment is responsible for ensuring, through overview and independent assessment, the timely development of adequate environmental controls in concert with DOE's energy technology RD&D programs. The projects directly supported by ECT are primarily focused on generating and evaluating environmental control data to produce judgments and give guidance to DOE's RD&D program and policy formulation. In contrast, the energy technology offices have direct responsibility for RD&D of environmental control hardware and processes integral to and in phase with their respective energy technology RD&D programs.

This annual survey of environmental control technology activities was originally initiated in FY 1977 by the Administrator, Energy Research and Development Administration, and published as DOE/EV-0030, "Environmental Control Technology Activities of the Department of Energy in FY 1977," dated November 1977. It was continued in FY 1978 by the Secretary of Energy and published as DOE/EV-0031, "Environmental Control Technology Activities of the Department of Energy in FY 1978," dated March 1979. This FY 1979 compilation of DOE environmental control RD&D activities and associated funding identifies the related resources committed by DOE in support of its objective to protect and enhance the general health, safety, and welfare of the Nation concurrent with its research, development, and demonstration of energy systems.

II. PURPOSE AND SCOPE

The purpose of this report is to provide an annual identification and summarization of environmental control RD&D activities and associated funding conducted by DOE in conjunction with developing environmentally acceptable energy technologies. Because environmental control technology is an integral part of the DOE energy technology RD&D effort, the total program activity in this area is very difficult to explicitly describe. This survey describes all environmental control activities as reported by all DOE Offices conducting energy and environmental RD&D activities.

As the third in a series of annual reports on environmental control RD&D activities within DOE, this report may serve as a basis for evaluating program trends. The report presents background material that contributes to the capability to evaluate and assess the environmental control accomplishments, issues, gaps, and overlaps associated with energy development within DOE, in conjunction with other agencies, and in the private sector. A measure of the change in emphasis in the environmental control technology activities within DOE is also presented, indicating shifts, if any, in funding levels for each of the energy technologies.

This report summarizes the inputs received from the energy technology areas. These inputs were submitted in accordance with a description of environmental control related activities, which are those activities directed at research, development, and demonstration of processes, procedures, systems, subsystems, and strategies that directly or indirectly eliminate, minimize, or mitigate environmental impacts.

III. SUMMARY

Total DOE FY 1979 budget outlay allocated to environmental control activities, as shown in Table 3-1, was \$421,533,000, or 5.0 percent of the total FY 1979 DOE budget. In FY 1978, \$294,066,000 or 3.3 percent of the total DOE budget was allocated to environmental control RD&D. Environmental control activity thus increased by 43 percent in budget outlays from FY 1978.

The distribution of the \$421,533,000 by energy technology category (independent of intra-DOE organizational structure) is depicted in Figure 3-1; fossil and nuclear energy technologies accounted for 91 percent of the total (20 and 71 percent, respectively). In FY 1978, fossil and nuclear energy accounted for a similar amount (90 percent), although the split was slightly different: 26 percent for fossil and 64 percent for nuclear. The difference in distribution is related to the increased emphasis on nuclear waste management. The majority of the fossil energy related activities, as in FY 1978, were again related to the coal program. Similarly, waste management activities represented the majority of the nuclear energy funds related to environmental control technology. Conservation and geothermal each made up 3 percent of the total. The remaining portion consisted of solar (1 percent), energy research (1 percent), and magnetic fusion energy (1 percent).

Figure 3-2 shows the distribution, by administrative office*, of the total DOE FY 1979 outlays related to environmental control activities. The vast majority (94 percent) of the FY 1979 projects were within the jurisdiction of the Office of Assistant Secretary for Energy Technology, including fossil, nuclear, solar, geothermal, magnetic fusion, and electric energy and energy storage systems. The remaining 6 percent were within the jurisdiction of the Office of Environment (4 percent), the Assistant Secretary for Conservation and Solar Energy (1 percent), and the Office of Energy Research (1 percent).

*The environmental control activities of DOE as described herein are based on inputs received from offices within DOE that existed at the time of submittal. In the latter part of FY 1979, the DOE organizational structure was revised. Future reports will include this revision: All conservation (except for electric energy systems) and solar projects will come from the Office of the Assistant Secretary for Conservation and Solar Energy, fossil energy projects will come from the Office of the Assistant Secretary for Fossil Energy, nuclear energy projects will come from the Office of the Assistant Secretary for Nuclear Energy, geothermal and electric energy systems projects will come from the Office of the Assistant Secretary for Resource Applications, and magnetic fusion energy projects will come from the Office of Energy Research. Energy research and environment and safety projects will continue to come from the Office of Energy Research and the Office of the Assistant Secretary for Environment, respectively.

Table 3-2 presents the funding breakdown for conservation energy. As shown in Figure 3-3, 36 percent of the funding was associated with buildings and community systems. This work was mainly directed at waste heat reduction, indoor air quality research, and water pollution control.

Fossil energy funding allocations are shown in Table 3-3. The associated distribution of funding is depicted in Figure 3-4 and consists of three main budget categories: (a) coal, (b) petroleum, and (c) gas, with the coal subprogram making up the majority (94 percent). A breakdown of the elements of the coal subprogram is presented in Table 3-4. As shown in Figure 3-5, the coal program activities associated with liquefaction, gasification, and direct combustion made up 74 percent (9, 24, and 41 percent, respectively) of the total coal program funding related to environmental control activities. The remaining 26 percent was related to advanced power systems (14 percent), mining research (10 percent), magnetohydrodynamics (1 percent), and advanced research and technology (1 percent).

Nuclear energy summary funding data are presented in Table 3-5. As shown therein and in Figure 3-6, the vast majority of the funding related to environmental control activities was in the area of waste management (99 percent), including both commercial and defense waste management and decontamination and decommissioning (D&D) activities.

In the solar energy technology area, solar electric applications programs (solar thermal electric, photovoltaics, wind energy, and ocean thermal) accounted for 84 percent of the total funding applicable to environmental control technology (Table 3-6 and Figure 3-7). Within that group, the main efforts were focused on the use of wind power to generate electricity from solar energy and analyses of the health and safety aspects. The remaining 16 percent was devoted to biomass projects.

Funding related to geothermal energy increased from the FY 1978 level (Table 3-7). As in FY 1978, the majority of the geothermal energy activities related to environmental control technology were in the areas of H₂S control, subsidence control, drilling technology, resource exploration, and hydrothermal technology applications.

Supporting research projects related to environmental control technology increased from FY 1978 (Table 3-8). However, the portion related to the total DOE effort remained at approximately 2 percent. The main topics of scientific research associated with environmental control technology were in the areas of air pollution control, actinide chemistry, and recovery of metals from fly ash.

Magnetic fusion energy projects related to environmental control technology increased from FY 1978, as shown in Table 3-9. Of the total \$2,595,000, most of the projects related to environmental control of magnetic fusion energy were in the area of development and technology (\$1,395,000), the remainder (\$1,200,000) being in the area of technical projects.

Environmental control activities supported by the Assistant Secretary for Environment are conducted in the Environmental Control Technology Division. The environment and safety funding data are shown in Table 3-10. Figure 3-8 depicts the apportionment of that funding, with most of it in the overview and assessment budget category (82 percent) and the remainder in the D&D category (18 percent). For overview and assessment, the funding data are shown in Table 3-11 to be \$12,205,000. Activities in this category include laboratory and site-specific environmental control data acquisition and assessments. Figure 3-9 depicts the breakdown of that funding and shows fossil energy (75 percent) and nuclear energy (18 percent) having the main emphasis (93 percent). The primary areas were in support of the independent overview and assessment of coal gasification projects for air, water, and solids pollution control and in the evaluation of controls for oil spills and the safety and environmental control aspects of handling, storing, transporting, and using liquefied gaseous fuels. In the nuclear area, the overview and assessment activities were divided between the nuclear fuel cycle (6 percent) and materials transportation (12 percent). As shown in Table 3-12, the funding for D&D was \$2,700,000. The D&D efforts, shown in Figure 3-10, were mainly in the area of radiological surveys (84 percent), with the remaining 16 percent related to remedial action program planning being conducted for formerly utilized Manhattan Engineer District/Atomic Energy Commission sites (FUSRAP), inactive uranium mill tailings sites, and specific surplus facilities. It should be noted that many of the D&D program activities and the seabed disposal program (from overview and assessment) were transferred in FY 1979 from the Office of Environment to the Office of Nuclear Energy. The data contained herein reflect that transfer.

Table 3-1. Total DOE Environmental Control Activities Funding Allocation

Energy-Related Activities	FY 1979 Budget Outlays* Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Conservation	11,598 (444)	3.3
Fossil Energy	85,700 (9,182)	11.7
Nuclear Energy	301,254 (4,856)	8.3
Solar	3,308 (216)	0.8
Geothermal	12,362 (207)	9.7
Supporting Research	4,716	2.2
Magnetic Fusion Energy	<u>2,595</u>	0.7
Total	421,533**	5.0**
Total DOE FY 1979 Outlays:		<u>\$8,437,471,000</u>

*FY 1979 funding within the Office of the Assistant Secretary for Environment is included in the individual rows and allocated as shown in parentheses. (See Tables 3-10 through 3-12 for details.)

**FY 1977 values were \$184,683,000 and 3.4%.
FY 1978 values were \$294,066,000 and 3.3%.

TOTAL DOE FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$421,533,000

Figure 3-1. Distribution of Total DOE Environmental Control Activities Related to FY 1979 Funding by Energy Category

TOTAL DOE FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$421,533,000

Figure 3-2. Distribution of Total DOE Environmental Control Activities Related to FY 1979 Funding by Administrative Office

Table 3-2. Funding for Environmental Control Activities Related to Conservation

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Buildings and Community Systems	4,000	6.6
Electric Energy Systems	2,509	6.4
Energy Storage Systems	2,645	4.6
Industrial Energy Conservation	300	1.2
Transportation Applications	<u>1,700</u>	2.0
Total	11,154*	3.2*
Total Conservation FY 1979 Outlays:		<u>\$349,074,000</u>

*FY 1977 values were \$5,948,000 and 4.8%.

FY 1978 values were \$10,163,000 and 2.1%.

TOTAL CONSERVATION FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$11,154,000

Figure 3-3. Distribution of Environmental Control Technology Funding in the Conservation Energy Technology Program

Table 3-3. Funding for Environmental Control Activities Related to Fossil Energy

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Coal	72,118	11.4
Petroleum	3,300	5.0
Gas	<u>1,100</u>	4.2
Total	76,518*	10.5*
Total Fossil Energy FY 1979 Outlays: <u>\$726,082,000.</u>		

*FY 1977 values were \$86,194,000 and 17.8%.
FY 1978 values were \$68,030,000 and 11.2%.

TOTAL FOSSIL ENERGY FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$76,518,000

Figure 3-4. Distribution of Environmental Control Technology Funding
in the Fossil Energy Technology Program

Table 3-4. Funding for Environmental Control Activities Related to Coal Program

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Liquefaction	6,256	4.1
Surface Gasification	16,900	15.2
In-situ Gasification	600	4.5
Utilization*	40,144	21.0
Mining Research and Development	7,518	11.6
Magnetohydrodynamics	700	0.8
Total	72,118**	11.4**
Total Coal Program FY 1979 Outlays: <u>\$633,464,000</u>		

*Formerly Advanced Power Systems, Direct Combustion, and Advanced Research and Technology

**FY 1977 values were \$81,897,000 and 20.0%.
FY 1978 values were \$65,000,000 and 12.5%.

TOTAL COAL SUBPROGRAM FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$72,118,000

Figure 3-5. Distribution of Environmental Control Technology Funding in the Coal Subprogram of Fossil Energy Technology

Table 3-5. Funding for Environmental Control Activities Related to Nuclear Energy

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Naval Reactors	0	0
Nuclear Fuel Cycle	3,906	0.4
Uranium Resources and Enrichment	0	0
Waste Management	<u>292,492</u>	60.9
Total	295,398*	7.9*
Total Nuclear Energy FY 1979 Outlays: <u>\$3,746,774,000</u>		

*FY 1977 values were \$62,195,000 and 2.5%.

FY 1978 values were \$167,080,000 and 5.8%.

TOTAL NUCLEAR ENERGY FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$296,398,000

Figure 3-6. Distribution of Environmental Control Technology Funding in the Nuclear Energy Technology Program

Table 3-6. Funding for Environmental Control Activities Related to Solar Energy

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Solar Applications	0	0.0
Biomass	499	2.1
Solar Thermal Electric	517	0.6
Photovoltaics	321	0.4
Wind Energy	1,035	1.9
Ocean Thermal	<u>720</u>	2.0
Total	3,092*	0.7*
Total Solar Energy FY 1979 Outlays: <u>\$429,665,000</u>		

*FY 1977 values were \$2,686,000 and 1.4%.

FY 1978 values were \$4,315,000 and 1.9%.

TOTAL SOLAR FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$3,092,000

Figure 3-7. Distribution of Environmental Control Technology Funding
in the Solar Energy Technology Program

Table 3-7. Funding for Environmental Control Activities Related to Geothermal Energy

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Geothermal	<u>12,155</u>	9.6
Total	12,155*	9.6*
Total Geothermal FY 1979 Outlays: <u>\$127,188,000</u>		

*FY 1977 values were \$8,771,000 and 17.9%.

FY 1978 values were \$8,742,000 and 10.7%.

270
43
313

Table 3-8. Funding for Environmental Control Activities Related to Supporting Research

Program*	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Basic Energy Sciences	4,626	2.3
Satellite Power Systems	<u>90</u>	3.0
Total	4,716**	2.2**
Total Supporting Research FY 1979 Outlays: <u>\$214,914,000</u>		

*Does not include the general science and research portion of energy research activities that do not have environmental control aspects.

**No report in FY 1977.

FY 1978 values were \$2,871,000 and 1.7%.

Table 3-9. Funding for Environmental Control Activities Related to Magnetic Fusion

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Development and Technology	1,395	2.4
Technical Projects	<u>1,200</u>	0.9
Total	2,595*	0.7*
Total Magnetic Fusion FY 1979 Outlays: <u>\$348,641,000</u>		

*FY 1977 values were \$780,000 and 0.3%.
FY 1978 values were \$1,335,000 and 0.5%.

Table 3-10. Funding for Environmental Control Activities Related to Office of Environment

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Percent of Total FY 1979 Budget Related to Environmental Control Activities
Overview and Assessment	12,205	23.9*
Decontamination and Decommissioning	<u>2,700</u>	100.0
Total	14,905**	6.9**
Total Office of Environment FY 1979 Outlays: <u>\$216,115,000***</u>		

*Portion of budget line item entitled "Overview and Assessment."

**FY 1977 values were \$17,973,000 and 8.1%.
FY 1978 values were \$31,530,000 and 14.4%.

***Includes environmental control technology, health and environmental research, National Environmental Policy Act affairs, operational and environmental safety, technology impacts, and technology assessments.

TOTAL OFFICE OF ENVIRONMENT FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$14,905,000

Figure 3-8. Distribution of Environmental Control Technology Funding in the Environment and Safety Program

Table 3-11. Overview and Assessment Breakdown of FY 1979 Funding Related to Environmental Control Activities

Energy-Related Category	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Apportionment of FY 1979 Outlays for Environmental Control Activities (Percent)
Conservation	444	3
Fossil Energy	(9,182)	(75)
Coal	4,699	38
Petroleum and Natural Gas	3,653	30
Oil Shale	830	7
Nuclear Energy	(2,156)	(18)
Nuclear Fuel Cycle	740	6
Transportation	1,416	12
Solar	216	2
Geothermal	<u>207</u>	<u>2</u>
Total	12,205	100

TOTAL OVERVIEW AND ASSESSMENT FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$12,205,000

Figure 3-9. Distribution of Environmental Control Technology Funding in the Overview and Assessment Subprogram

Table 3-12. Decontamination and Decommissioning Breakdown of FY 1979 Funding Related to Environmental Control Activities

Subprogram	FY 1979 Budget Outlays Related to Environmental Control Activities (\$ in thousands)	Apportionment of FY 1979 Outlays for Environmental Control Activities (Percent)
Radiological Surveys	2,281	84
Planning	<u>419</u>	<u>16</u>
Total	2,700	100

TOTAL DECONTAMINATION AND DECOMMISSIONING FY 1979 FUNDING
RELATED TO ENVIRONMENTAL CONTROL TECHNOLOGY: \$2,700,000

Figure 3-10. Distribution of Environmental Control Technology Funding in the Decontamination and Decommissioning Subprogram

IV. RESULTS

To aid in obtaining consistent inputs to the survey, specific ground rules and requirements were established. The primary ground rule involved the definition of environmental control, which is as follows:

Those activities directed at research, development, and demonstration of processes, procedures, systems, subsystems, and strategies that directly or indirectly eliminate, minimize, or mitigate environmental impacts.

Examples of such activities include

- Add-on process (e.g., electrostatic precipitator for particulate control);
- Energy process design (e.g., fluidized bed combustion of coal); and
- Energy process "tuning" efforts (e.g., reuse of wastewater).

The criteria for applicability to environmental control were as defined in Table 4-1. It was recognized that a clear "black-and-white" set of guidelines was not possible across the board for all energy RD&D programs. Panel sessions were conducted, as necessary, to reconcile the vast majority of applicability uncertainties.

As part of the input requirements, a standardized tabular format was developed. This table, shown in the following sections, provides the following information:

- A heading that shows the DOE office involved and the main title for the specific subject.
- "Project/element" title, which is a description of the principal nature of the project and element. A "project" is categorized as a discrete, definitely formulated task, and an "element" is a division of a program consisting of two or more projects that are technology or subject interrelated.
- A checklist to define the primary character of the project such as research, studies, design, etc.

Table 4-1. Criteria for Applicability to Environmental Control Technology

Category	Applicable	Not Applicable
Major Facilities	RD&D	Energy production operational facilities (e.g., power stations and office space)
Process Design	Environmental impact mitigation	Associated solely with process operations and reliability
Research, Analyses and Studies	Directly or indirectly necessary to control environmental impact	Those not affecting the environment
Assessments	Partially or directly related to determining the need for new or additional environmental controls	Evaluating the characteristics of a process that does not affect the environment
Process Stream Sampling and Analysis	Evaluate or determine the effectiveness and performance of existing or anticipated environmental control provisions	Routine operational monitoring
Training Programs	Related to environmental control	Energy development that is not coincident with environmental control technology

- A description of the relationship of the project or element to environmental control technology. For example, the use of scrubbers, filters, washers, or precipitators to remove toxic gases or particulates from a combustion process.
- The FY 1979 funds allocated to environmental control technology. Funding was to include operating, capital equipment, and plant budget outlay dollars that were determined to be related to environmental control technology.

The following sections describe the detailed inputs obtained.

CONSERVATION

Input for the conservation energy projects related to environmental control technology were received from divisions within the Offices of the Assistant Secretary for Conservation and Solar Energy and the Assistant Secretary for Energy Technology. These divisions were buildings and community systems (Table 4-2), transportation (Table 4-3), and industrial programs (Table 4-4) from Conservation and Solar Applications and electric energy systems (Table 4-5) and energy storage systems (Table 4-6) from Energy Technology.*

The total FY 1979 conservation energy outlay related to environmental control technology activities was \$11,154,000. Buildings and community systems accounts for 36 percent of the total with eight projects concerning waste heat reduction, indoor air quality research, flammability studies and formaldehyde tests of insulation material, programmatic environmental development plan, reduction in waste materials and water pollution, and solid waste recovery. The remaining portion of the total conservation funding is divided among electric energy systems (22 percent), energy storage systems (24 percent), transportation energy conservation (15 percent), and industrial energy conservation (3 percent).

Electric energy projects related to environmental control technology totaled \$2,509,000 and are primarily in the area of electric field effects of power lines. Projects related to energy storage systems (\$2,645,000) involve development of design and stability criteria for long-term operations of storage reservoirs, safety evaluation of hydrogen Homestead Complex and other hydrogen systems, evaluation of aluminum plant waste heat utilization and environmental effects, identification of effluents and obtaining sampling data in battery development programs, design and development of flywheels in electric vehicles, and assessment of environmental impacts and mitigation measures in the electric/hybrid vehicles program. For transportation energy systems, \$1,700,000 in related funding, the major areas are diesel particulate research; combustor concepts for gas turbines; electric vehicle safety; and assessment of environmental control issues, emissions, and advanced concepts design. Finally, for industrial programs, the funding related to environmental control technology was \$300,000, mainly in the areas of air, water, and solid waste pollution controls for various commercial processes such as aluminum remelt, cupola and high performance forge furnaces, paint and cement, pulp paper sludge drying, and waste recovery.

*In future reports, all of the conservation inputs to the DOE environmental control survey will come from Conservation and Solar Applications, with the exception of electric energy systems inputs, which will be supplied by the Office of the Assistant Secretary for Resource Applications.

The conservation energy outlays related to environmental control technology constitutes approximately 3 percent of the total FY 1979 budget funding. This is a \$991,000 increase in the total from FY 1978 and a slight increase in the portion of the total budget related to environmental control activities.

Table 4-2. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Conservation and Solar Energy
 PANEL SESSION SUBJECT: Building and Community Systems

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
<u>Community Systems</u>										
Integrated Systems			X						Waste heat reduction/other environmental aspects mitigation. 50%	1,300
<u>Urban Waste</u>										
National Center for Resource Recovery										
Anaerobic Digester Using Fluidized Bed Combustion	X				X				Reduction of waste materials. 85%	250
Sludge Digestion	X		X			X			Reduction of water pollution. 100%	250
Combined Treatment of Liquid and Solid Waste	X			X					Reduction of water pollution. 100%	150
			X						Solid waste recovery. 50%	250
<u>Architectural and Engineering Systems</u>										
Ventilation Program	X	X				X			Indoor air quality research. 75%	1,400
Insulation Testing	X	X				X			Flammability studies and formaldehyde tests of urea-formaldehyde insulation. 18%	300
Environmental Development Plan						X			Programmatic Environmental Development Plan. 100%	100
									Total	4,000

Table 4-3. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Conservation and Solar Energy
 PANEL SESSION SUBJECT: Transportation

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional		
Gas Turbine/Bus Marketing Demonstration							X	Identify environmental issues to be measured in both revenue and test track operations. 3%	150
Advanced Transmission			X					Noise reduction design. 20%	40
Controlled-Speed Accessory Drive					X			Exhaust emission effects. 10%	20
Diesel Particulate Research						X		Emissions assessment. 100%	400
Rankine Bottoming Cycle for Heavy Duty Trucks			X		X			Design and vehicle instrumentation for future emission mapping. 15%	35
Gas Turbine Engines	X	X				X		Evolve and evaluate advanced combustor concepts. 50%	250
Stirling Engine		X	X			X		Assess emission, combustor concepts, and ecological effects. 5%	150
Turbocompound Diesel Engine Engineering Demonstration					X	X	X	Assess emissions. 7%	25
Investigation of Alcohol/Gasoline Blends	X					X		Assess emissions, including unregulated. 80%	80
Characterization of Alcohol/Gasoline Blends						X		Assess emissions, including unregulated. 10%	25
Modification of Alcohol Fuels	X							Emissions and toxicological effects. 5%	12
Investigation of Methanol Fuel	X							Emissions and ecological effects. 30%	45
Alcohol Fuels Fleet Data Bank							X	Gather emission/environmental data. 15%	6
Design Data for Hydrogen Engine	X							Design influence on emissions. 15%	15
Near-Term Electric Vehicle Program	X	X	X	X		X		Electric vehicle safety - crash energy management accident avoidance, non-operating safety. 4%	230
Electric Vehicle Handling Stability Project	X			X	X	X		Electric vehicle handling and stability test and measurement. 100%	100

Table 4-3 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Conservation and Solar Energy
 PANEL SESSION SUBJECT: Transportation

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Driver Awareness Training		X				X	X		Local air quality due to reduced travel and fuel use. 5%	9
Mileage Guide						X	X		Local air quality due to reduced travel and fuel use. 1%	9
Voluntary Truck and Bus Fuel Economy Improvement Program						X	X		Local air quality due to reduced travel and fuel use. 1%	1
Automotive Microcarburetor					X			X	Emission testing and evaluation. 3%	2
Bottoming Cycle for Pipelines			X			X			Preliminary environmental assessment. 5%	3
Alternative Fuel/Energy for Nonhighway Transport		X				X			Assessment study. 7%	3
Alternative Fuels for Medium Speed Rail and Marine Applications		X		X		X			Assessment study. 3%	5
Bottoming Cycle for Marine Diesels			X		X	X			Preliminary environmental assessment. 5%	7
Fuel Cell Application to Pipelines		X				X			Preliminary environmental assessment. 5%	8
Environmental Development Plan						X	X	X	Programmatic Environmental Development Plan. 100%	70
									Total	1,700

Table 4-4. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Conservation and Solar Energy
 PANEL SESSION SUBJECT: Industrial Programs

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Cupola Furnace Modification				X	X				Control air and solid waste pollution. 3%	22
Coal-Fired Aluminum Remelt			X						Control air and solid waste pollution. 1%	25
High Performance Forge Furnace			X	X	X				Control air pollution. 5%	53
Direct Reduction of Aluminum	X	X							Control air and solid waste pollution. 5%	25
Fuel Saving Paint Plant					X	X			Control air pollution. 2%	25
Cogeneration		X	X						Control air pollution. 1%	10
Blended Cement		X		X					Radiation assessment. 5%	10
Pulp Paper-Sludge Drying		X	X	X					Control water pollution. 6%	10
Acetylene From Coal		X	X	X					Control air and water pollution. 1%	10
Polypropylene Waste to Fuel Oil		X	X	X					Control air and water pollution. 2%	10
Refuse as Fuel for Cement Kiln		X	X	X					Control air pollution. 3%	10
Lube Oil Recovery		X	X	X					Control air, water, and solid waste pollution. 1%	10
New Fertilizer Process		X	X	X					Control air and water pollution. 2%	10
Environmental Development Plan						X			Programmatic Environmental Development Plan. 100%	70
									Total	300

Table 4-5. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Electric Energy Systems

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Instrumentation Study for Electrostatic Field Effects	X	X		X					Establish requirements for traceability performance criteria and meter specifications for electric field measurement equipment. 100%	150
High-Voltage Direct Current (DC) Test-Line-Electric Field Effects of DC Lines	X			X	X	X			Investigate field effects of DC lines.	59
DC Biocage Design	X		X	X					Complete experimental design of test enclosures. 50%	140
500 kV-Transmission Line Electric Fields and Noise Measurements	X	X			X	X			Measure and assess fields and noise in representative locations along an active line.	200
Research to Investigate the Biological Effects of High-Voltage Electrical Fields	X	X			X	X			Study biological effects of 60-Hz electric fields on small animals. 100%	800
Research to Study Mechanisms of Electric Field Effects	X	X				X			Determine electric field effects on the central nervous system. 10%	25
Biomedical Effects of Transmission Systems	X	X	X		X				Determine field effects on circadian rhythm. 10%	20
Study to Develop a Bioeffects Assay	X	X				X			Determine field effects on nervous system and behavior.	75
Primate Behavior and Biological Study	X	X		X	X	X			Study electric field effects on baboons.	500
Transmission Line Noise Measurements	X	X	X	X	X	X			Investigate audible noise produced by EHV lines and relate to human response.	180
Optimization of Overhead Transmission Line Support Systems	X		X	X		X			Minimize environmental impact of new support structures.	300
Application of Low-Temperature Technology to Transformers	X	X		X	X	X			Evaluate conceptual designs safe to personnel and environment.	60
									Total	2,509

Table 4-6. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Energy Storage Systems

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Thermal Energy Storage Building Code Analysis	X	X				X			Address health and safety hazards of thermal energy storage. 50%	50
Institutional Barriers to Commercialization of Chemical Heat Pump Systems	X	X				X			Environmental aspects of chemical heat pump systems. 50%	10
Application of Thermal Energy Storage to Process Heat and Waste Heat Recovery-Environmental Aspects	X	X				X			Evaluate environmental effects of using waste heat from aluminum plant to supply heating for Bellingham, Washington. 100%	150
Environmental Analysis and Assessment of Selected Hydrogen Production and Storage Systems	X	X			X	X			Prepare environmental assessment of hydrogen systems. 50%	46
Modification and Operation of the Hydrogen Homestead Hydride Vessel Energy Storage System	X	X			X	X			Provide detailed safety evaluation of the Hydrogen Homestead Complex. 10%	2.5
Compressed Air Energy Storage (CAES) - Reservoir Stability Criteria for Temperature and Pressure Cycling	X		X	X					Develop design and stability criteria for long-term operation of storage reservoirs. 100%	1,500
Stability and Design Criteria for CAES Reservoirs-Rock Mechanics and Geology Components	X	X			X	X			Evaluate effects of pressure-temperature cycling on underground rocks and caprocks. 100%	62
Hazard Assessment of Zn/Cl ₂ and Zn/Br ₂ Load Leveling Batteries	X	X			X	X			Determine hazards that involve the halogen and compare the two systems with respect to safety in load-leveling applications. 100%	72
Hazard Assessment of Sodium/Sulfur Batteries for Load Leveling Mission	X	X	X		X	X			Assist in development of safety standards for this battery. 50%	49
Develop Containment Technology to Allow for Safe Release of Overpressures in Zinc-Chlorine Batteries (Electric Vehicles)	X	X	X	X					Control chlorine releases and reduce safety hazards in electric vehicle applications. 100%	20

Table 4-6 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Energy Storage Systems

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Hazard Assessment of Zinc-Chlorine Electric Vehicle Batteries	X	X			X	X			Assess hazards associated with widespread use of this battery in electric cars and compare to conventional gas vehicles. 100%	75
Near-Term Electric Vehicle Program (Phase II, General Electric Co.)	X	X				X			Identify safety hazards of battery-propelled vehicles, develop remedies, and promote public awareness of the concept. 5%	75
Near-Term Electric Vehicle Program (Phase II, Garrett Corp.)	X	X	X	X					Ensure safe operation of energy storage flywheels in electric vehicles through research on design and development. 5%	75
Hazard Assessment of Near-Term and Advanced Batteries for Electric Vehicles	X	X			X	X			Assess hazards and identify constraints in use of near-term and advanced batteries in electric vehicles. 100%	51
Hazard Assessment of Sodium/Sulfur Batteries for the Electric Vehicle Mission	X	X			X	X			Assess hazard potential of sodium/sulfur batteries when used in electric vehicles. 100%	33
Biomedical and Environmental Effects of Electrical Storage Systems: Environmental and Health Related Issues	X	X			X	X			Identify effluents from stages of battery development, exposure modes, transport, fate, and effect of battery materials on environment and public health. 50%	134
Biomedical and Environmental Effects of Electrical Storage Systems: Toxicity of Metals That Have Significance in Energy Storage Systems.	X	X			X	X			Obtain data on toxicity of metals of importance in battery development and determine their role in tumorigenesis, metabolic alteration, and disturbance of biological rhythms. 50%	134
Aquifer Storage Environmental Assessment	X	X			X	X			Conduct environmental assessment to determine the need for an EIS. 100%	80

Table 4-6 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Energy Storage Systems

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Environmental Assessment for the Electric and Hybrid Vehicles Program	X	X			X	X			Review and assess environmental effects of Electric and Hybrid Vehicles Program and assess health and safety aspects of battery and flywheel systems. Also determine need for an EIS. 100%	26
									Total	2,644.5

FOSSIL ENERGY

Fossil energy environmental control efforts conducted within the Office of the Assistant Secretary for Energy Technology* are presented in Tables 4-7 through 4-16. The total FY 1979 fossil energy outlay associated with environmental control efforts was \$76,518,000, which represents approximately 10 percent of the FY 1979 fossil energy budget. Compared to FY 1978, funds for these activities increased by \$8,488,000.

As in FY 1978, the major portion of the applicable FY 1979 outlays (94 percent or \$72,118,000) was devoted to the coal program. Within this program, two major areas contributed 80 percent of the \$72,118,000: utilization (56 percent) and gasification (24 percent). In the utilization subprogram, the majority of the funding associated with environmental control efforts was with direct combustion projects dealing with air and water pollution and toxics control technology. The remaining funding in this subprogram was associated with advanced power systems (fuel cells and heat engine/recovery) air pollution controls and advanced research and technology projects involving air and water pollution controls and National Environmental Policy Act (NEPA) compliance efforts. In gasification, the majority of the funding associated with environmental control technology was in the area of environmental control research for toxics control technology and NEPA compliance.

The remaining 20 percent (\$14,474,000) of the total coal program funding (\$72,118,000) with environmental control aspects was associated with mining research and development (R&D) (10 percent), liquefaction (9 percent), and magnetohydrodynamics (1 percent). In mining R&D, the environmental control efforts were directed at primary and secondary pollution sources and effects as well as mitigation measures. Liquefaction projects dealt with toxics (sources, effects, and controls) and NEPA compliance primarily associated with SRC I and II, pilot plants, and third-generation liquefaction processes. Magnetohydrodynamics projects were directed primarily at air monitoring research.

The remaining \$4,400,000 of the total fossil energy funding related to environmental control efforts (\$76,518,000) was within the petroleum and enhanced gas recovery programs. The petroleum subprogram accounted for \$3,300,000 in the areas of oil shale (primary water pollution control technology) and enhanced oil recovery (primary and secondary pollution control technology). The enhanced gas recovery program accounted for the remaining \$1,100,000, with environmental control efforts mainly directed at land/water secondary control technology and NEPA compliance.

*In future reports, the fossil energy inputs to the DOE environmental control survey will be supplied by the Office of the Assistant Secretary for Fossil Energy.

Table 4-7. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - Liquefaction

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Solvent Refined Coal (SCR) Pilot Plants*	X			X					Toxics - sources and effects (primary)	300
	X			X					Toxics - control technology	300
	X								Toxics - health effects research**	500
Liquefaction Support		X							NEPA compliance	500
SRC I and II	X			X					Toxics - sources and effects (primary)	300
	X			X					Toxics - control technology	500
	X								Toxics - health effects research**	500
Third Generation	X			X					Toxics - sources and effects (primary)	300
	X								Toxics - health effects research**	200
Exxon Donor Solvent Pilot Plant ⁺	X			X					Toxics - sources and effects (primary)	400
	X			X					Toxics - control technology	1,500
		X							NEPA compliance	200
Direct Hydrogenation (H-Coal) ⁺⁺		X							NEPA compliance	400
Engineering Support - ORNL	X			X					Toxics - sources and effects (primary)	300
Liquefaction - PETC	X			X					Administrative costs	56
									Total	6,256

*Reduction in expenditures from 1978 due to status of pilot projects, whereby effort was on investigating process changes in 1979 rather than developing control technologies.

**Studies on toxicity of process liquids and solids.

⁺Reflects detailed engineering stage of pilot plant.

⁺⁺Reduction in dollars reflects construction phase in 1979, rather than control technology R&D.

Table 4-8. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - High-Btu Gasification

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology. (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Bigas		X							NEPA compliance	500
Demo-Pipeline Gas		X							NEPA compliance	7,400*
Synthane	X		X						Toxics - source and effects	200**
	X		X						Toxics - control technology	200
Hygas - Pilot Plant	X		X						Toxics - source and effects	200
	X		X						Toxics - control technology	200
									Total	8,700

*Includes site monitoring, borings, and studies for air, water, geologic, and socioeconomic baseline; preparation of an EA and EIS; and detailed design of environmental process tradeoffs, for both the Continental Oil Company and Illinois Coal Gasification Company demo projects, to ensure NEPA compliance.

**Decrease from FY 1978 reflects re-evaluation and termination of synthane project in FY 1979.

Table 4-9. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Fossil - Low-Btu Gasification

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Entrained Bed Gasification	X			X					Toxics - control technology	200
Fluidized Bed Gasification	X			X					Toxics - control technology	600
Technical Support	X			X					Toxics - sources and effects	300
	X			X					Toxics - control technology	800
		X							NEPA compliance	800
Demo - Low/Medium Btu		X							NEPA compliance	400
Gasifiers-In-Industry		X							NEPA compliance	1,500*
Fuel Gas - Small Scale		X							NEPA compliance	1,000**
Environmental Support - METC	X			X					Pollution control technology	2,200
								X	Administrative costs	400
									Total	8,200

*Includes joint DOE/NIOSH environmental monitoring and evaluation programs at Pike County, Kentucky, and University of Minnesota sites.

**Includes detailed design of control options and environmental site assessments for Eri Mining Company project. Demonstration was terminated at end of Phase 1 during FY 1979 because of environmental considerations.

Table 4-10. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - Utilization*

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Direct Combustion - AECT**	X			X					Toxics - control technology (primary)	7,000
Direct Combustion - Systems	X			X					Air pollution control technology	21,600
Fuel Cells	X			X					Secondary air pollution control technology	4,500
Heat Engine/Recovery	X			X					Secondary air pollution control technology	5,600
Direct Combustion PETC	X			X					Primary air and water pollution sources and effects	230
	X			X					Primary air and water pollution control technology	420
	X			X					Secondary air pollution control technology	180
								X	Administrative	6
AR&TD - PETC								X	Administrative costs - air and water programs	140
		X							NEPA compliance - air and water	39
								X	Remedial federal pollution control	2
								X	Costs of fuel switching - air	27
AR&TD - BETC			X						Planning abatement and control programs	200
AR&TD - LETC		X							NEPA compliance	200
									Total	40,144

*Formerly Advanced Power Systems, Direct Combustion and Advanced Research and Technology.

**AECT = Advanced Environmental Control Technology, a new program moved in 1979 from EPA to DOE. Expect increased budget in 1980. Entire \$7,000,000 program is considered control technology and accounts for most of increase in spending in these programs.

Table 4-11. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology

PANEL SESSION SUBJECT: Fossil - Enhanced Oil Recovery

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Enhanced Oil Recovery - METC	X			X					Secondary pollution control technology	400
Enhanced Oil Recovery	X			X					Primary control technology	100
									Planning abatement operations	100
									Total	600*

*Decrease from 1978 reflects more accurate assessment of actual costs and fact that environmental assessments for most field projects were completed in FY 1978.

Table 4-12. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - Enhanced Gas Recovery

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Enhanced Gas Recovery - METC	X			X					Land/water secondary control technology	800
	X			X				X	Administrative costs	100
		X							NEPA compliance	200
									Total	1,100*

*Increase from 1978 reflects more accurate assessment of actual costs.

Table 4-13. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Fossil - Mining Research and Development

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology * (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Mining R&D	X			X					Primary source and effects	3,700
	X			X					Land/water control technology (primary)	1,000
	X			X					Secondary sources and effects	1,800
	X			X					Secondary control technology	1,000
Mining - PETC								X	Pollution control - Federal facilities - process changes	18
									Total	7,518*

*Small increase from 1978 reflects overall budget increase.

Table 4-14. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - Oil Shale

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Oil Shale Programs	X			X					Primary control technology	2,000
Oil Shale - LETC	X			X					Primary water pollution control technology	400
	X			X				X	Administrative costs	100
								X	Water pollution control technical support	200
									Total	2,700*

*Increase from 1978 reflects major increase in overall oil shale budget in 1979 (from \$28 to \$49 million, as shown in the FY 1979 "Gold Book").

Table 4-15. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology

PANEL SESSION SUBJECT: Fossil - In Situ Coal Gasification

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
In Situ Gasification	X			X					Secondary water/land control technology	400
In Situ Gasification - LETC	X			X					Primary water pollution control technology	200
									Total	600*

*Reduction from 1978 reflects different stage in project activities. The effect in 1978 was the purchase of equipment and operation of four tests. The effect in 1979 was the evaluation of the tests.

Table 4-16. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Fossil - Magnetohydrodynamics

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Magnetohydrodynamics	X			X					Air monitoring research (primary)	500
		X							NEPA compliance	100
					X				Abatement and control monitoring	100
									Total	700*

*Represents environmental control technology R&D undertaken in FY 1979.

NUCLEAR ENERGY

The nuclear energy inputs to this survey, received from the Office of the Assistant Secretary for Energy Technology*, are contained in Tables 4-17 and 4-18. The total outlay associated with environmental control technology was \$296,398,000, which is approximately 8 percent of the total nuclear energy FY 1979 budget. Waste management, commercial and defense, accounted for 99 percent (\$292,492,000) of that total, with the major projects being the terminal isolation program; transuranic waste terminal repository technology; low-level; transuranic, and high-level waste treatment technologies; and the remedial action programs for surplus facilities, formerly utilized Manhattan Engineer District/Atomic Energy Commission sites, inactive uranium mill tailings sites, and Grand Junction, Colorado, offsite contamination (Table 4-18).

Compared to FY 1978, the waste management outlays related to environmental control technology for FY 1979 almost doubled, increasing by \$142,570,000. Part of this increase was due to the transfer of the seabed disposal program funding and most of the remedial action program funding from the Environmental Control Technology Division in the Office of Environment. When related to the total budget, there was a decrease by approximately 3 percent from FY 1978 to FY 1979.

The remaining 1 percent (\$3,906,000) of the nuclear energy environmental control efforts are shown in Table 4-17 and consisted mainly of effluent control studies, control of radioactive releases, alternate fuels assessment, radiological dose models assessments, and atmospheric diffusion studies.

*In future reports, the nuclear energy inputs to the DOE environmental control survey will be supplied by the Office of the Assistant Secretary for Nuclear Energy.

Table 4-17. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Nuclear Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Environmental Effects of Advanced LMFBR Fuels	X	X			X	X			Alternate fuels assessment. 100%	346
Evaluation of Models for Assessment of LMFBR Radioactivity Releases		X				X			Assessment of radiological dose models. 100%	245
Meteorological Studies--NOAA*	X	X			X				Diffusion studies. 85%	210
Sodium Combustion Product Aerosol Studies	X	X			X	X			Transport and deposition measurements and model development. 100%	150
Dry and Wet/Dry Cooling Tower Studies	X	X		X					Effluent control. 100%	125
Meteorological Effects of Thermal Energy Releases**	X	X			X	X			Atmospheric effects of power plants. 100%	450 (ET share)
Radioactivity Control Technology	X	X	X			X			Control of LMFBR powerplant radioactivity releases. 100%	750
Off-Gas Management (Fuel Reprocessing Plants)	X	X	X	X	X				Effluent control. 100%	1,000
Environmental Radiation Safety	X	X				X			Nuclear fuel behavior. 33%	50
Advanced Safety Technology	X	X		X		X			Nuclear fuel behavior. 33%	450
Safety Support	X	X				X			Diffusion studies. 33%	130
									Total	3,906

*Joint funding with NRC which contributes funding approximately equal to DOE's.

**Jointly funded (ET/EV).

Table 4-18. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Waste Management

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Long-Term Airborne Waste Treatment Technology			X	X					Develop technology, criteria, and requirements for waste treatment, noble gas immobilization, tritium immobilization, particulate filter, carbon-14 immobilization, iodine immobilization, and other airborne waste measurement.	4,765
Long-Term High-Level Waste (HLW) Treatment Technology			X	X					Develop and implement defense HLW treatment technology for disposal with minimum future maintenance requirements, high degree of isolation from man's environment, and with acceptable waste and containers as multiple barriers for geologic isolation.	47,295
Long-Term Low-Level Waste (LLW) Treatment Technology			X	X					Support commercial LLW land burial through development of technology for containment and treatment of DOE and commercial LLW.	5,923
Long-Term Transuranic Waste Treatment Technology			X	X					Ensure safe handling and storage of existing and future TRU through technology development for processing and handling in various forms to be compatible with long-term management.	18,400
TRU Terminal Repository Technology			X	X					WIPP - Provide a repository for permanent disposal of defense TRU and conduct experiments with defense HLW in bedded salt.	48,863
Terminal Isolation Program (Basalt) (Nevada) (ONWI) (Seabed)			X	X					Develop technology to isolate radioactive waste consistent with long-term criteria.	126,406 (30,959) (20,342) (72,305) (2,800)
Formerly Utilized MED/AEC Sites Remedial Actions					X	X		X	Decommission properties formerly used for MED/AEC operations.	1,520
Grand Junction Remedial Actions					X	X		X	Perform remedial actions in accordance with PL 92-314 and PL 95-236.	1,581

Table 4-18 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Waste Management

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Uranium Mill Tailings Sites - Remedial Actions					X	X		X	Perform remedial actions in accordance with PL 95-604 and within 7 years of EPA standards promulgation.	1,011
Management of Surplus Facilities					X	X		X	Develop and improve D&D techniques for DOE-owned surplus facilities.	16,308
Technology Transfer							X		Transfer D&D technology to commercial sector and other Government agencies.	50
West Valley Remedial Action		X							Provide remedial action at Nuclear Fuel Services, West Valley, New York.	0
Domestic Spent Fuel Storage								X	Ensure adequate spent fuel storage space and transportation capability to accommodate continued operation of nuclear powerplants in the United States.	2,897
International Spent Fuel Storage								X	Ensure adequate spent fuel storage space and transportation capability for limited amounts of foreign spent fuel to avoid proliferation.	2,784
Waste System Evaluation and Public Interactions		X				X	X		Prepare Generic Environmental Impact Statement; establish consultation/concurrence process for interaction with states.	4,055
Transportation R&D		X	X	X					Address problems of nuclear material transport and support DOE programs.	2,166
PNL Landlord Activities								X	Support overall operation of Pacific Northwest Laboratories through equipment and facilities upkeep. 10%	3,650
Solidification Process Demonstration				X					Demonstrate the current technology for immobilization of HLW from reprocessing of fully irradiated commercial reactor spent fuel.	4,818
									Total	292,432

SOLAR

The solar inputs were received from the Office of the Assistant Secretary for Energy Technology* and cover the environmental control aspects of projects within both the Offices of Energy Technology and Conservation and Solar Energy; they are presented in Tables 4-19 through 4-23. The total FY 1979 outlays related to environmental control technology was \$3,092,000 or approximately 1 percent of the solar FY 1979 budget. Compared to FY 1978, this was a decrease of \$1,223,000 and 1.2 percent. Of the \$3,092,000 total, 84 percent was in the solar electric applications programs with the following breakdown by subprograms: wind energy conversion systems (\$1,035,000), ocean thermal energy conversion (\$720,000), solar thermal (\$517,000), and photovoltaics (\$321,000). The remaining 16 percent of the total (\$499,000) was within the area of biomass energy conversion.

Within the wind energy conversion systems subprogram, the main environmental control emphasis is on health and safety analyses, electromagnetic interference and noise assessments, monitoring of test sites, and compliance with National Environmental Policy Act requirements. Within the ocean thermal energy conversion area, the majority of the funding is related to environmental impact issues, design control of power systems, cleaning techniques, and safety control. Solar thermal projects related to environmental control technology are involved with assessing environmental effects and impacts, characterizing movement of sodium oxide/hydroxide aerosols and molten salts, ecological site data, and effects of solar thermal fluids on ecosystems. Photovoltaics, the remaining solar electric applications subprogram, is concerned with environmental effects and issues, especially in the area of toxicity measurement and control.

In the biomass subprogram, the primary funding is related to assessment of control technology needs for direct combustion, fermentation residue, and woody biomass projects.

*In future reports, all of the solar inputs to the DOE environmental control survey will be supplied by the Office of Conservation and Solar Energy.

Table 4-19. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Biomass (Solar)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Biomass Energy Systems Programmatic Environmental Assessment (ORNL)						X			Assess entire biomass program.	100
Direct Combustion Facility Environmental Report		X				X			Assess control technology needs.	125
Fermentation Residue Environmental Control		X				X			Assess control technology needs.	14
Soil and Tillth Effects of Agricultural Residue Removal	X					X			Assess control technology needs.	30
Fuels and Chemicals From Woody Biomass Program	X					X			Assess pollutant removal of sewage effluent by woody biomass.	70
		X				X			Assess pathological and entomological problems for woody biomass.	20
Biomass Energy Systems Program Management Assistance (PNL) Treatment of Biomass Gasification Wastewaters	X					X			Assess control technology needs.	40
Environmental Control Technology for Biomass Gasification						X			Assess environmental control technology needs.	80
Environmental Control Technology for Direct Combustion of Biomass						X			Assess environmental control technology needs.	20
									Total	499

Table 4-20. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Solar Thermal

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Solar Thermal Programmatic Assessment						X			Assess potential environmental effects of federal program. 50%	35
Shenandoah Total Energy System Environmental Assessment		X				X			Review/assess potential site-specific environmental impacts. 50%	50
Fort Hood Total Energy System Assessment		X				X			Review/assess potential site-specific environmental impacts. 50%	50
Movement of Accidentally Released Aerosols (Used in Advanced Central Receiver Designs)		X							Field measurements and modeling to characterize movement of sodium oxide/hydroxide aerosols; to better assess environmental effects. 100%	150
Assessment of Solar Thermal Power System Working Fluids/Wastes on the Desert Ecosystem		X							Study effects of solar thermal fluids such as eutectic salts on desert ecosystem and develop control strategies. 100%	22
Environmental Effects of Different Solar Collector/Heliostat Systems		X			X				Monitoring/analysis of impact of different solar thermal systems on desert ecologies and microclimates. 100%	42
Barstow 10-MWe Solar Thermal Site Characterization and Monitoring		X				X			Gather ecological site data for future comparisons. Plan for future environmental monitoring during plant construction and operation. 100%	148
Environmental Concern With Solar Thermal Molten Salt Transfer Fluid		X				X			Characterize movement of accidentally released molten salt and the impact on the environment. 100%	20
									Total	517

Table 4-21. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Photovoltaics (Solar)

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General	
Mission Analysis of Photovoltaic Energy Systems		X							Investigate environmental aspects. 5% 21
Natural Bridges, Utah, 100-kW Experiment						X			Environmental assessment. 50% 100
Industrial Health and Safety Study		X							Study of industrial hygiene issues for silicon manufacturing processes. 50% 100
Health and Environmental Effects Study		X							Health and environmental effects study and workshop. 50% 100
									Total 321

Table 4-22. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Wind Energy Conversion Systems (Solar)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Small Machines	X	X			X	X			Monitoring of test sites; examination and compliance with ordinances, health and safety analyses, noise assessment.	170
MOD-0A Machine	X	X		X	X	X			Electromagnetic interference; monitoring; regulatory compliance.	135
MOD-1 Machine	X	X			X	X			Monitoring, regulatory compliance, health and safety analyses, noise assessment.	100
MOD-2 Machine	X	X			X	X			Regulatory compliance, health and safety analyses.	250
Supporting Research and Technology	X	X		X	X	X			Natural Environmental Design Handbook published; Safety Requirements Handbook drafted.	200
Siting			X			X			Environmental design criteria for wind energy conversion systems.	100
Design Requirements	X	X		X	X	X			Control methods; health and safety system requirements, maintenance and reliability standards.	80
									Total	1,035

Table 4-23. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Ocean Thermal Energy Conversion (Solar)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Programmatic EV for Ocean Thermal Energy Conversion (OTEC)						X	X	X	Identification of control measures for OTEC program.	30
OTEC Program Management Support - Environmental Issues	X	X			X	X	X	X	Physical, climatic, biological, and ecological impact issues. 50%	120
Experimental Study of Flow Problems Related to OTEC	X	X	X						Design control of effluent discharges. 25%	45
OTEC Ocean Measurements	X	X			X	X			Data base collection for design control specifications. 10%	120
OTEC Mission Analyses			X	X			X		Design control for institutional and utility interface. 10%	60
OTEC Power Systems	X		X	X					Design control of power systems cleaning techniques for OTEC. 5%	200
OTEC Ocean Systems	X		X	X				X	Design of OTEC ocean systems safety control. 1%	120
OTEC Biofouling and Corrosion	X	X			X				Design of OTEC cleaning systems. 1%	25
									Total	720

GEO THERMAL

Geothermal energy inputs to the FY 1979 DOE environmental control technology survey were received from the Office of the Assistant Secretary for Energy Technology* and are presented in Table 4-24. Geothermal FY 1979 total outlay related to environmental control activities was \$12,155,000 or approximately 10 percent of the FY 1979 geothermal total budget. Compared to FY 1978, this was an increase of approximately \$3,413,000; however, when compared to the total geothermal budget, there was basically no change in the percentage.

Almost one-fourth of the geothermal energy projects having environmental control aspects were in the areas of monitoring and sampling and analysis: well logging technology, Project-Wellhead, exploration technology, and the geothermal loop experiment facility pilot plant. The next major categories involved subsidence research and control, waste disposal, compliance with the National Environmental Policy Act, reservoir properties and assessments, and fluid analyses.

In FY 1978, geothermal energy listed over 50 projects having environmental control aspects with a funding range of \$4,000 to \$1,300,000. In this survey for FY 1979, the total projects listed were just under 50, and the funding ranged from \$7,000 to \$1,277,000. The number of projects and their respective funding ranges basically remained the same.

* In future reports, the geothermal energy inputs to the DOE environmental control survey will be supplied by the Office of the Assistant Secretary for Resource Applications.

Table 4-24. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Geothermal Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Concrete Polymer Composite Material				X					Material development to increase well safety. 10%	7
High Temperature Polymer Well Cement	X			X					Well material development to improve integrity. 30%	60
Precipitation and Scaling	X		X	X	X				Waste materials control. 10%	32
Silica Precipitation and Brine Management	X	X			X	X			Waste materials control. 25%	56
Materials Identification		X	X			X			Materials design specifications. 15%	30
Rock Mechanics	X	X			X				Determination of reservoir rock properties. 10%	81
Geothermal Well Logging Technology Development		X	X	X					Data acquisition and instrumentation development. 30%	681
Log Interpretation	X	X	X	X	X				Reservoir properties determination. 20%	199
Reservoir Engineering Techniques	X	X		X	X				Testing of reservoir assessment tools and techniques. 50%	482
Geothermal Component Test Facility			X	X		X			Design and evaluation of environmental control systems. 10%	62
Geopressure Static and Dynamic Well Tests				X	X				Fluid analysis and reservoir evaluation. 15%	1,000
Hot Dry Rock Technology Development		X	X	X	X	X			Environmental support studies and environmental design considerations in technology development. 59%	435
Subsidence Control Program	X	X	X	X	X	X			Subsidence research and control research and control technology. 100%	1,225
Induced Seismic Studies	X	X			X	X			Study and evaluation of induced seismic potential related to geothermal development. 100%	600

Table 4-24 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Geothermal Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
H ₂ S Applied R&D	X	X	X	X	X	X			H ₂ S control technology. 100%	188
EIA/EIS Evaluations						X	X		NEPA environmental reviews. 20%	60
Raft River Thermal Loop Facility			X	X	X				Environmental control systems design and environmental sampling. 10%	663
Hawaii Geothermal Project-Wellhead Generator		X	X	X	X	X			Environmental monitoring, effects, and evaluation. 20%	468
Seal Materials Program	X			X					Seal material standards development for fluid control. 20%	50
Exploration Technology	X	X	X	X	X				Surface measurement of reservoir properties. 30%	914
Environmental Assessment, Louisiana Sites					X	X			NEPA compliance analyses. 20%	10
Geopressured Environmental Studies	X	X							Baseline studies. 100%	50
Brazoria Site Monitoring		X			X	X			Monitoring methodology. 20%	52
Subsidence Research	X	X			X				Develop techniques for subsidence predictions. 100%	200
Alternative Materials for Non-Electric Demonstration Plant	X	X		X					Materials design specifications. 10%	17
Materials R&D	X	X	X	X					Materials development specifications. 20%	80
Cement Materials Screening	X	X			X				Materials design specifications. 20%	12
Elastomer and Polymer Screening	X	X			X				Materials design specifications. 20%	10
Computer Modeling of Fluid Chemistry	X	X		X					Chemical process modeling. 20%	40
Injection Stimulation Chemistry	X	X		X					Materials disposal technology. 90%	352
Local Corrosion Field Tests	X	X	X	X					Integrity of casings. 90%	162

Table 4-24 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy Technology
 PANEL SESSION SUBJECT: Geothermal Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Sampling and Analysis Techniques	X	X		X	X				Techniques to evaluate contaminants. 50%	86
Geothermal Fluid Injection Characterization	X	X		X	X				Waste disposal analysis. 90%	563
Reservoir and Inline Monitoring	X	X		X	X				Sampling and analysis of fluids. 50%	80
Geochemical Control, Instrumentation Development	X	X	X	X	X				Fluid composition measuring and control. 20%	30
Geothermal Petrophysics	X	X			X				Determination of reservoir rock projections. 20%	10
Subsidence Leveling at Raft River		X			X	X			Measurement of subsidence. 100%	50
H ₂ S Control-CuSO ₄ Scrubbing	X	X	X	X	X	X			Control of H ₂ S. 100%	33
H ₂ S Sensor	X		X	X					Develop H ₂ S sensor. 100%	112
Fluid Supply and Injection Raft River		X	X	X	X				Waste disposal. 50%	1,277
Environmental Monitor-Raft River					X	X			Environmental monitoring. 100%	200
First 50-MWe Demonstration Plant		X			X	X			Environmental impact statement. 5%	360
Brazoria County Impact Project		X			X	X	X		Study of environmental impacts. 90%	25
Reservoir Predictions	X	X		X	X				Develop reservoir analysis technology. 30%	50
Prospect Specific Studies		X			X	X			Environmental studies. 50%	107
Parperdue, Louisiana, Well			X	X	X	X			Environmental studies. 2%	172
Puna Site Environmental Monitoring					X	X			Environmental monitoring. 100%	100
Geothermal Loop Experimental Facility Pilot Plant			X	X	X	X			Studies, measurements, injections. 20%	622
									Total	12,155

ENERGY RESEARCH

Inputs for basic energy sciences (BES) and satellite power systems were received from the Directorate Office of Energy Research and are presented in Tables 4-25 and 4-26, respectively. The total outlay devoted to environmental control technology was \$4,716,000 or approximately 2 percent of the total Energy Research FY 1979 budget. Since BES represents 98 percent of the Energy Research input, a better comparison with last year can be seen by observing that approximately 2.3 percent of the total BES budget was devoted to environmental control related activities, compared to approximately 1.8 percent in FY 1978.

The BES projects related to environmental control technology (Table 4-25) involve research into the nuclear and materials sciences and chemistry, engineering, mathematics, and geoscience. Most of the projects within BES associated with environmental control technology are in the area of chemical sciences. These include sulfur dioxide fixation, atmospheric pollution monitoring, photochemistry, actinide chemistry, and materials chemistry. There are a total of 40 BES projects ranging in funding allocations related to environmental control technology from \$5,000 to \$500,000.

There are two satellite power system projects listed in Table 4-26, both under electromagnetic compatibility. The total funding related to environmental control was \$90,000 or only 2 percent of the total Energy Research submittal.

Table 4-25. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy ResearchPANEL SESSION SUBJECT: Basic Energy Sciences

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Cyclic Separations Process Research (BNL)	X								Removal of T_2 from effluents. 30%	42
Isotope Separation R&D (Mound)	X				X				Methods of enrichment of environmental tracers. 10%	29
Atomic and Molecular Properties and Their Relation to Separations (Mound)	X								Diffusion coefficients. 15%	45
Investigation of Mechanism of Removal of Radioisotopes From Waste Streams (Mound)	X								Trace removal from effluents. 100%	75
Waste Stream Processing Studies (ORNL)	X								Removal of trace Pu from wastes. 100%	149
Fundamental Concepts of Resource Recovery (ORNL)	X								Disposal of coal fly ash. 50%	151
Fundamentals of Separations Chemistry (ORNL)	X								Removal of U from fertilizer. 50%	85
Analytical Separations (Ames)	X				X				Removal of trace organics from water. 40%	38
Lasers in Analytical Chemistry (Ames)	X				X				Pollution monitoring research. 30%	59
Study of Atmospheric Trace Gases by Mass Spectrometry (MS) (ANL)	X				X				Tracing pollution sources. 85%	122
Determination of Fragile Molecules in the Environment (BNL)	X				X				Derivatization chromatography. 100%	110
Environmental Chemistry (LBL)	X				X				Pollution sources. 20%	22
MS R&D - Organic Analysis (ORNL)	X				X				Analysis of coal liquids. 20%	39
Quantification of Fossil Fuels by MS (NBS)	X				X				Analysis of coal liquids. 60%	48
Fundamental Studies in Isotope Chemistry (SUNY)	X								Sources of CO_2 . 10%	11
Mechanism of Gas Permeation Through Polymeric Membranes (Syracuse)	X								Separation of Kr + Xe from reactors and reprocessing plants. 40%	18

Table 4-25 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy Research
 PANEL SESSION SUBJECT: Basic Energy Sciences

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Solvent Extraction Using High Molecular Weight Amines (Texas Southern)	X								Removal of toxic metals from industrial wastes. 100%	35
Collection of Noble Gases With Oxidizing Salts (ANL)	X								Removal of radioactive rare gas isotopes from the environment with oxidizing salts. 40%	112
Labile SO ₂ Complexes (LASL)	X								Organic and organometallic compounds for the absorption of SO ₂ from gas streams. 40%	72
Oxyacids of Sulfur (LBL)	X								Basic aqueous chemistry of SO ₂ expected to be relevant to the removal of sulfur dioxide from stack gases of power plants. 40%	26
Rotating Fluidized Bed Combustor (BNL)	X	X							Hot bed studies of combustion and pollutant generation and retention. 20%	5
Fluidized Bed Modeling (PNL)	X								General development of mathematical models to describe the phenomenon of bubble coalescence in fluidized beds. 20%	15
Photochemistry of Materials in the Stratosphere (LBL)	X								Photochemical reactions of nitrogen oxides. 100%	220
Research in Chemical Kinetics (California/Irvine)	X								Photochemistry of chlorofluorocarbons and reactions under stratospheric conditions. 50%	70
Combustion and Pollution Chemistry: Gas Phase Radiolysis (ANL)	X								Reactions of transient species of interest in combustion and atmospheric pollution. 50%	270
Fixation of Sulfur Dioxide in Fluidized Bed Combustion (ANL)	X				X				Fixation of sulfur dioxide by dolomite in fluidized bed. 100%	385
Heat Transfer and Nucleation (ANL)	X								Superheating phenomena in boiling. 50%	30
Corrosion Chemistry (ANL)	X								Corrosion behavior of molten salts. 100%	230
Ceramics Research - Coal Structure and Impurities (ORNL)	X								Identification and analysis of impurities in coal. 50%	50

Table 4-25 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy ResearchPANEL SESSION SUBJECT: Basic Energy Sciences

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Recovery of Metal Values From Fly Ash (Ames)	X								Recovery of aluminum from fly ash. 50%	70
Materials Chemistry Related to Fusion Reactor Programs (ORNL)	X								Studies of loss of tritium in heat exchange materials. 100%	500
Tritium Chemistry Associated With the Lithium Blanket and Container Materials (LASL)	X								Control of tritium in fusion reactors. 100%	170
Characterization of Compounds and Alloys (Illinois)	X								Identification and analysis of impurities in coal. 50%	135
Radiation Damage and Environmental Effects in High Level Waste Storage Glasses Using Transmission Electron Microscopy (California/Davis)	X								Study of radiation damage and environmental degradation and leaching behavior of radioactive waste storage glasses. 100%	64
Electronic Properties of Amorphous Silicon Dioxide and Metallic Ions in Silicate Glasses (Missouri/Kansas City)	X								Study of behavior of ionic behavior of radioactive waste products, such as actinides, in a silicate glass matrix. 50%	20
Research in Nuclear Chemistry (Florida State)	X								Characterization of the behavior of the actinide elements under carefully controlled laboratory conditions applicable to the environment. 35%	24
Actinide Chemistry (LBL)	X	X	X	X	X	X			Development of new, actinide-specific chelating agents to be used in aqueous systems and agents compatible with the human biosystem. Measurement of formation constants of actinides with environmentally important ligands. 25%	230
Heavy Element Chemistry Research (ANL)	X								Chemical behavior of actinide ions in aqueous solution. 50%	480
Chemistry of Transuranium Elements and Compounds (ORNL)	X								Actinide ion exchange behavior of clays and other geologic media. 40%	360

Table 4-25 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Energy ResearchPANEL SESSION SUBJECT: Basic Energy Sciences

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Physical-Chemical Studies of the Transuranium Elements (Tennessee)	X								Actinide environmental chemistry. 15%	10
									Total	4,626

Table 4-26. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy Research

PANEL SESSION SUBJECT: Satellite Power System

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Electromagnetic Compatibility										
- Radio Frequency Interference - Electromagnetic Impacts						X			Identify electromagnetic impact for mitigation. 100%	65
- Mitigation Methods		X	X						Study, design, and initiate selected testing. 100%	25
									Total	<u>90</u>

MAGNETIC FUSION ENERGY

Magnetic fusion energy inputs to the FY 1979 DOE environmental control technology survey were received from the Office of the Assistant Secretary for Energy Technology* and are presented in Table 4-27. Magnetic fusion energy FY 1979 total outlay related to environmental control activities was \$2,595,000 or 0.7 percent of the FY 1979 magnetic fusion energy total budget. Compared to FY 1978, this represents an increase of \$1,260,000 and 0.2 percent in the total budget. The primary emphasis, as in FY 1978, was on tritium containment, control, permeation, and cleanup.

*In future reports, the magnetic fusion energy inputs to the DOE environmental control survey will be supplied by the Office of Energy Research.

Table 4-27. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: Energy TechnologyPANEL SESSION SUBJECT: Magnetic Fusion Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
A. Development and Technology										
1. Tritium Systems Test Assembly				X	X				A major purpose of this facility is the demonstration of tritium containment and control technology, under both normal and accident conditions, for the Engineering Test Facility to be operated in the 1980s. Approximately 30% of the FY 1979 budget is committed to containment and control technology development.	500 (OP) 500 (EQ)
2. Alloy Development	X								Approximately 20% of this program element in FY 1979 is devoted to studies of tritium permeation through potential fusion reactor materials. Successful development of low-permeation alloys will significantly reduce routine tritium releases from fusion powerplants.	100 (OP) 10 (EQ)
3. Fusion Reactor Safety Research	X			X					Approximately 17% of this program element in FY 1979 is devoted to the development of control technology such as instrumentation development, improved getters, and permeation studies for tritium systems, to better handle and contain this substance. Successful development of this type of technology will reduce routine tritium releases from a fusion powerplant.	230 (OP) 55 (EQ)
B. Technical Projects										
1. Tokamak Fusion Test Reactor				X					Tritium cleanup systems to contain routine and accidental spills of tritium within facility. Development of these systems will provide design and operating experience for later magnetic fusion facilities. These represent approximately 2% of the FY 1979 project budget.	1,000 (PACE) 100 (OP)

Table 4-27 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR Energy Technology
 PANEL SESSION SUBJECT: Magnetic Fusion Energy

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
2. Fusion Materials Irradiation Testing Facility				X					Tritium cleanup from liquid lithium systems. Development of these systems will provide design and operating experience for later magnetic fusion facilities. These represent approximately 1% of FY 1979 project budget.	100 (OP)
									Total	2,595

OFFICE OF ENVIRONMENT

All of the projects applicable to environmental control (Table 4-28) in the Office of Environment were within the cognizance of the Environmental Control Technology Division. The total FY 1979 outlay associated with environmental control activities was \$14,905,000, or approximately 7 percent of the total Office of Environment FY 1979 budget. In comparison to the funding allocation reported in FY 1978, this represents a decrease of \$16,625,000 (approximately 7 percent in relationship to total Office of Environment funding). Overview and assessment activities made up 82 percent (\$12,205,000) of the total, and decontamination and decommissioning (D&D) projects made up the remaining 18 percent (\$2,700,000).

Overview and assessment activities within the Environmental Control Technology Division are listed under the budget heading of environmental engineering and are mainly in the areas of supporting fossil and nuclear energy development. Of the \$12,205,000 funding allocation within environmental engineering, fossil energy related activities made up 75 percent and nuclear energy, 18 percent. The remaining 7 percent was divided into conservation (3 percent), geothermal (2 percent), and solar (2 percent).

In the fossil energy area, the majority of the applicable Office of Environment funding was devoted to environmental control activities related to the production of energy from coal. The remainder was related to petroleum and natural gas programs with emphasis on the safety and environmental control aspects of handling, storing, transporting, and using liquefied gaseous fuels.

Nuclear energy related activities were divided into two main areas. The first involved the analysis of nuclear fuel cycles to assess the adequacy of existing environmental controls and the need for additional control requirements. The remainder of the nuclear energy associated activities were in nuclear materials transport efforts devoted to transportation studies involving risk assessments and testing, including shipping casks for radioactive wastes. Additionally, transportation statistics on accident frequency and severity and analyses of their significance were kept current, using the latest computer technology.

Geothermal, solar, and conservation activities were a small portion of the total environmental engineering funding related to environmental control technology. Principal emphasis was placed on H₂S, liquid waste, and noise control for geothermal related activities; environmental and fire hazards and noise pollution control for solar related activities; and urban and industrial waste control and electric power transmission environmental impacts for conservation related efforts.

D&D activities related to environmental control technology totaled \$2,700,000 and were divided into two major categories: radiological surveys and planning, which accounted for 84 and 16 percent respectively of the funding. These projects are in support of the inactive uranium mill tailings and formerly utilized Manhattan Engineer District/Atomic Energy Commission sites (FUSRAP) remedial action programs.

Compared to FY 1978, the D&D funding decreased by \$13,774,000. This was due to the transfer of funds and responsibilities in FY 1979 from the Office of Environment to the Office of Nuclear Energy, for the direct remedial action efforts involved in the surplus sites, FUSRAP, and inactive mill tailings sites programs.

Table 4-28. Projects With Environmental Control Aspects

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional		
<u>Coal</u>									
Environmental Control Technology for Generation of Electric Power From Coal (ANL)		X				X		Comparative assessments of control technologies. 100%	750
Assessment of Radioactive Emissions From Coal Mining, Processing, and Combustion (LASL)		X		X	X	X		Control of radiological emissions. 100%	125
Environmental Control Assessment of Cogeneration as a District Heat Source (ORNL)		X				X		Emission control options. 100%	75
Assessment of Environmental Control Options for Control of CO ₂ in the Global Atmosphere (ORNL)						X		Impact of CO ₂ on global environment. 100%	30
Environmental Effects of Dry/Wet Cooling Towers (PNL)		X				X		Effluent control studies. 100%	100
Assessment of Radiological Impact of Western Coal Utilization (Mound)		X		X	X	X		Control of radiological emissions. 100%	90
Removal of NO _x and SO ₂ From Flue Gas Through Electron Beam Irradiation (Research-Cottrell, Inc.)		X		X		X		Dual control of NO _x and SO ₂ emissions. 100%	276
Environmental Assessment of Coal Waste Disposal in Ocean Waters (N.Y. ERDA)		X		X	X	X		Waste disposal. 100%	100
Experimental Investigation of Acoustic Agglomerator Systems for Fine Particle Control (State University of New York at Buffalo)		X		X	X	X		Particle control options. 100%	40
Porons Dike Intake Evaluation (EPA and N.E. Power Co.)		X		X		X		Evaluate intake control. 100%	130
Novel Methods of Respirable Dust Removal (General Electric)		X				X		Dust control. 100%	40
Evaluation of Pollutants From Flash Hydrolysis (BNL)		X		X		X		Evaluate pollutants versus control requirements. 100%	70

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional	General		
Environmental Control Aspects of In Situ Coal Gasification: Groundwater Quality Change and Subsidence Effects (LLL)		X		X	X	X			Identify control requirements. 100%	310
Assessment of Environmental Control Technology for Coal Conversion Wastewater Systems (ORNL)	X			X		X			Evaluate adequacy of existing control methods and identify new control options. 100%	175
Coal Conversion--Hydrocarbon and Carbon Monoxide Control (ORNL)				X	X	X			Emission control. 100%	100
Environmental Assessment for Gasifiers in Industry (ORNL)		X		X	X	X			Emissions assessment and control options. 100%	400
Treatment of Coal Conversion Wastewaters (PETC)		X		X	X	X			Characterize process wastewaters, evaluate effluents, concentrations, and devise treatment methods. 100%	100
Improved Water Management of Coal Conversion Processes (Arthur G. McKee & Company)		X			X				Water pollution control studies. 100%	53
Control of Emissions From Gasifiers Using Coal With a Chemically Bound Sulfur Scavenger (Battelle, Columbus)		X		X		X			Pretreat of gasifier feedstock to control sulfur in product gas. 100%	130
Analysis and Testing of Chemical Recovery From Coal Conversion Plant Wastewater Streams (Concentration Specialists, Inc.)		X			X	X			Assess the potential for reverse osmosis and/or freezing to concentrate select coal treatment wastewaters. 100%	15
Evaluation of Solid Wastes From Synfuels (ORNL)		X		X	X	X			Assess control requirements. 100%	100
Environmental Control Needs for Entrained Gasifier (BYU)		X			X	X			Define environmental control requirements. 100%	1
H-Coal Field Evaluation of Environmental Control Technology (ORNL)		X			X	X			Environmental control performance and options. 100%	25
Environmental Control Technology Survey of U.S. Strip Mining Sites (ANL)		X			X	X			Evaluate control technologies for new and expanded sites. 100%	380

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional	General		
Trace Element Characterization and Removal/ Recovery From Raw Coal and Coal Preparation Wastes (LASL)		X			X	X			Identify coal trace elements and options for removal and recovery. 100%	275
Evaluation of the Effect of Coal Cleaning on Fugitive Elements (BCR)		X			X	X			Assess coal preparation techniques and controls. 100%	100
Energy Materials Transportation Systems Characteristics and Potential Problems Now Through Year 2000 (PNL)		X				X			Identify potential problems associated with energy materials transportation. 100%	324
Environmental Control Support Activities (Aerospace Corporation)								X	Define and catalog all the DOE and ECT projects related to environmental control technology. 100%	275
Environmental Control Aspects of Coal Slurry (LBL)	X								Define environmental control needs. 100%	75
Assessment of Environmental Control Technology for Selected First Generation Coal Gasifiers (PNL)						X			Provide economics for existing and new control methods. 100%	5
Environmental Control Technology Wastewater Workshop (UCLA)		X							Study of wastewater control options. 100%	30
									Subtotal (Coal)	4,699
<u>Petroleum and Gas</u>										
LNG Spill Effects Program (LLL)		X				X			Preparation of LNG spill test program. 100%	1,400
Design for Medium-Scale LNG Spill Tests (Holmes & Narver, Inc.)			X						Determine requirements for medium scale test site. 100%	96
Integrated LNG Safety and Control Program (PNL)		X				X			Assess environmental control and safety options. 100%	320

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Environment
 PANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional	General		
Scale Effects in LNG Hazard Analysis and Testing (MIT)		X				X			Impact of scaling on LNG testing. 100%	80
LNG Experimental Spill Tests (USNWC)	X				X				Analysis and planning for field tests. 100%	576
Atmospheric Methane Detection (MIT)	X	X			X	X			Laboratory and field tests of sensors. 100%	5
Evaluate Feasibility of Methods and Systems for Reducing LNG Tanker Fire Hazards (Arthur D. Little, Inc.)						X			Assess control options. 100%	30
Study of Gelled LNG (Aerojet Energy Conversion Company)	X					X			Collect basic data to be used for control and safety assessments. 100%	55
Medium-Scale Spill Tests (REECO)				X					Preparation for spill tests. 100%	104
LNG Alternate Plan (R&D Associates)								X	Develop alternate research options. 100%	131
Boiling of LPG on Water (MIT)	X				X	X			Determine rate of boiling and measure spreading. 100%	48
LPG Hazard Assessment (Applied Technology Corporation)	X	X				X			Evaluate LPG hazards. 100%	290
LPG Research Assessment (PNL)		X				X			Assess LPG controls. 100%	130
Assessment of Activated Carbon for Environmental Control of Trace Organics in Petroleum Refinery Wastewater (ANL)	X					X			Evaluation of the effectiveness of activated sludge and activated carbon wastewater treatment. 100%	71
Burning of Oil Spills (PNL)		X				X			Compile bibliography, assess prior work, and develop environmental control alternatives. 100%	130
Assessment of Environmental Control Aspects of Treatment of Enhanced Oil Recovery Wastewater Cleanup (University of Tulsa)	X				X	X			Assess efficiency and practicability of membrane processes for wastewater treatment. 100%	32

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Environment
 PANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional		
Assessment of Environmental and Safety Controls for Hydrogen (LASL)		X				X		Determine control issues and needs of large-scale hydrogen transport. 100%	155
								Subtotal (Petroleum and Gas)	3,653
<u>Oil Shale</u>									
Environmental Control Technology for In Situ Oil Shale Retorts: Water/Gas Migration (LBL)		X			X	X		Identify pollutants and required controls. 100%	250
Spent Shale as a Control Technology for Oil Shale Retort Water (LBL)		X		X	X	X		Assess use of spent shale as a water cleanup media. 100%	75
Assessment and Environmental Controls for Mercury Emissions During Oil Shale Retorting (LBL)		X			X	X		Determine Hg control requirements. 100%	50
Assessment and Control of Water Contamination Associated With Shale Oil Extraction and Processing (LASL)		X			X	X		Control assessments. 100%	150
Assessment of Environmental Control for Wastewaters in In Situ Oil Shale Retorting (PNL)	X	X				X		Assess current technology for treatment and disposal of wastewaters. 100%	205
Preliminary Environmental Control Assessment of Rio Blanco Site (LLL)		X				X		Assess environmental intrusions and controls required. 100%	100
								Subtotal (Oil Shale)	830
<u>Solar</u>									
Environmental and Fire Hazards of Materials Used in Solar Heating and Cooling (Sandia)		X	X			X		Compile a list of solar heating and cooling materials and assess the environmental impacts of these materials. 100%	117
Assessment of Environmental Controls for Energy Production Facilities Using Solar-Derived Fuels (Ames)		X			X	X		Evaluate and assess control options in the conversion cycle. 100%	89

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional		
Preliminary Assessment of the Sounds of Large Wind Turbine Generators (Bolt, Berenak and Newman, Inc.)		X				X		Assess noise pollution. 100%	10
								Subtotal (Solar)	216
<u>Geothermal</u>									
Geothermal Loan Guaranty Program: Assessment of Environmental Control Technologies (LLL)						X		Assess environment and safety issues. 100%	43
Assessment of Environmental Controls for High Priority Regional Development (LLL)		X				X		Determine environmental control requirements. 100%	114
Evaluation of Noise Associated With Geothermal Energy Development (Long/Davy Associates)		X			X	X		Evaluate and assess noise control options. 100%	30
Preplanning Environmental Projects: Assessment of Environmental Control Technologies (LLL)		X				X	X	Determine environmental control requirements. 100%	20
								Subtotal (Geothermal)	207
<u>Conservation</u>									
Compressed Air Energy Storage: Environmental Control Concerns (PNL)		X				X		Identify control concerns. 100%	65
Assessment of Energy-Conserving Industrial Waste Treatment Technology (PNL)		X				X		Provide overview of current practices and prepare a plan for alternate control options. 100%	35
Environmental Control Technology Requirements for Future AC High-Voltage Overhead Transmission Lines (SRI)		X				X		Overview of environmental impacts. 100%	20
Review of State and Federal Environmental Regulations Pertaining to the Electrical Effects of Overhead Transmission Lines (Shah & Associates, Inc.)		X						Review government regulations versus environmental control needs. 100%	10

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: Environment
 PANEL SESSION SUBJECT: Environmental Control Technology (Environmental Engineering)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	* Development	Sampling and Analysis	Assessment	Instructional	General		
Environmental Control Requirements in Solid Waste Processing and Energy Recovery Facilities: Water Pollution (Ames)		X			X	X			Determine control requirements. 100%	170
Environmental Control Issues of Energy Storage: Battery Storage and Fuels Cells (LASL)		X				X			Evaluate environmental control issues. 100%	58
Assessment of Need for Noise Control Research on Power Transformers and Reactors (Bolt, Berenak and Newman, Inc.)		X				X			Assess noise control requirements. 100%	30
Assessment of Need for Controls for Modified Furnaces (Ames)		X			X	X			Assess environmental control issues. 100%	56
									Subtotal (Conservation)	444
<u>Nuclear Energy</u>										
Analysis of Nuclear Fuel Cycle (PNL)		X				X			Overview of total nuclear fuel cycle in terms of control issues. 100%	550
Study of Decommissioning Accelerators and Fusion Devices (ANL)		X				X			Study radiological safety measures. 100%	180
Laguna Pueblo Study (Laguna Pueblo)						X			Assess site radiological conditions.	10
Transportation Safety Studies (PNL)		X				X			Develop risk assessments for transport of radioactive material. 100%	315
Development of Material Constitutive Descriptions for Environmental and Safety Control Assessments of Energy Material Shipping Container Systems (ANL)	X					X			Shipping container assessments. 100%	170
Development of Structural and Thermal Analysis Methods for Environmental and Safety Assessments of Energy Material Shipping Container Systems (LASL)	X			X		X			Predict shipping container response to impact accident conditions. 100%	266

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR EnvironmentPANEL SESSION SUBJECT Environmental Control Technology (Environmental Engineering and Decontamination and Decommissioning)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development*	Sampling and Analysis	Assessment	Instructional	General		
Study of Physical Parameters of Transportation Accidents (Sandia)		X			X	X			Describe accident environment to which large casks could be exposed. 100%	70
Transportation Accident Environmental Data Bank (Sandia)								X	Storage of relevant environmental accident data. 100%	95
Shipment Assessment Consulting (SWRI)						X			Provide overview of shipping systems. 100%	30
Full-Scale Impact Testing for Environmental and Safety Control Assessments of Energy Material Shipping Container Systems (ORNL)	X	X				X			Full-scale testing for damage to casks and to contents. 100%	200
Scale Model Impact Testing for Environmental and Safety Control Assessments of Energy Material Shipping Container Systems (Battelle)	X	X		X	X	X			Scale model fabrication and testing. 100%	270
Subtotal (Nuclear Energy)										<u>2,156</u>
Subtotal (Environmental Engineering)										12,205
<u>Radiological Surveys</u>										
Oak Ridge National Laboratory Radiological Survey of Inactive Uranium Mill Tailings Sites (ORNL)					X	X			Radiological assessments. 100%	100
Engineering Assessments of Inactive Uranium Mill Tailings Sites (Ford Bacon & Davis Utah, Inc.)	X	X			X	X			Radiological surveys and support. 100%	200
Inactive Uranium Mill Tailings Support (EML)					X				Field measurements of radon. 100%	50
Asphalt Emulsion Sealing of Mill Tailings (PNL)	X	X				X			Study stabilization of mill tailings. 100%	123
Radiological Surveys of Selected Sites (ANL)					X	X			Determine radiological status of sites. 100%	66
Radiological Survey of Selected FUSRAP and Mill Tailings Sites (ORNL)					X	X			Determine radiological status of sites. 100%	500

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Decontamination and Decommissioning)

Project/Element Title	Primary Categories of Relationship to Environmental Control								Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional	General		
Radiological Survey of FUSRAP Sites (Mound)	X	X		X					Monitor Radon and Radon Daughters. 100%	230
Radon Monitoring of FUSRAP Sites (EML)					X				Monitor Radon and Radon Daughters. 100%	100
Radiological Assessment and Support for FUSRAP Sites (ANL)		X			X	X			Assess radiological conditions. 100%	267
Aerial Measurement Radiological Surveys (EG&G Idaho, Inc.)		X			X	X			Measure radiological status. 100%	305
Assistance for Decontamination and Decommissioning (D&D) Programs (Aerospace Corp.)		X				X		X	Provide independent overview of D&D remedial action programs. 100%	275
Remedial Action at Formerly Utilized Sites--Kellex Laboratory (LEVCO)		X	X						Radiological cleanup. 100%	10
Remedial Action at Formerly Utilized Sites--Kellex Laboratory (LEVCO)		X	X						Radiological cleanup. 100%	10
Kellex Cleanup--Pierport Property (ORO)		X	X						Radiological cleanup. 100%	45
									Subtotal (Radiological Surveys)	2,281
<u>D&D Planning</u>										
<u>Inactive Uranium Mill Tailings Sites Remedial Action Program</u>										
Extraction of Potentially Hazardous Radionuclides From Uranium Ores and/or Tailings (ORNL)		X				X			Assess extraction methods for control of radiation releases. 100%	50
Assessment of Ground and Surface Water Contamination From Uranium Mill Tailings (University of Colorado)						X			Define water contamination. 100%	54

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

Table 4-28 (Continued)

OFFICE OF ASSISTANT SECRETARY FOR: EnvironmentPANEL SESSION SUBJECT: Environmental Control Technology (Decontamination and Decommissioning)

Project/Element Title	Primary Categories of Relationship to Environmental Control							Portion of the Project or Element Related to Environmental Control Technology	FY 1979 Funding Allocation Related to Environmental Control Technology (\$ in thousands)
	Research	Studies	Design	Development	Sampling and Analysis	Assessment	Instructional		
<u>FUSRAP</u> Financial Assistance for Real Estate Appraisals at Canonsburg, Pennsylvania, Site (Commonwealth of Pennsylvania)								X Appraise properties prior to decontamination and decommissioning. 100%	15
<u>General</u> National D&D Planning Program (Atoms International)		X						Provide the framework for actions leading to the progressive reduction of the inventory of surplus facilities. 100%	300
								Subtotal (D&D Planning)	419
								Subtotal (D&D)	<u>2,700</u>
								Total (ECT)	14,905

*Although no development work is supported, feasibility studies to determine promising avenues of research are conducted.

V. BIBLIOGRAPHY

- Department of Energy, Environmental Control Technology Activities of the Department of Energy in FY 1977, DOE/EV-0030, Division of Environmental Control Technology (November 1977).
- _____, Fossil Energy Research and Development Program of the U.S. Department of Energy, FY 1979, DOE/ET-0013, Office of Assistant Secretary for Energy Technology (March 1978).
- _____, Division of Environmental Control Technology Program - 1977, DOE/EV-0015, Division of Environmental Control Technology (June 1978).
- _____, The United States Magnetic Fusion Energy Program, DOE/ET-0072, Office of Fusion Energy (August 1979).
- _____, Wind Energy Systems: Program Summary, DOE/ET-0093, Division of Distributed Solar Technology (December 1978).
- _____, Satellite Power Systems (SPS) Program Summary, DOE/ER-0022, Satellite Power Systems Project Office (December 1978).
- _____, Solar Heating and Cooling Demonstration Project Summaries, DOE/CS-0038/2, Division of Solar Applications (January 1979).
- _____, Ocean Systems Program Summary, DOE/ET-0083, Division of Central Solar Technology (February 1979).
- _____, Community Systems Program, DOE/CS-0072, Division of Building and Community Systems (February 1979).
- _____, Environmental Control Technology Activities of the Department of Energy in FY 1978, DOE/EV-0031, Division of Environmental Control Technology (March 1979).
- _____, Geothermal Energy: FY 1979 Programs; FY 1980 Plans, DOE/ET-0088, Division of Geothermal Energy (March 1979).
- _____, Fossil Energy Program Summary Document (FY 1980), DOE/ET-0087, Office of Program Control and Support (March 1979).
- _____, Project Summary Data - Thermal and Mechanical Energy Storage Program, FY 1979, DOE/ET-0091, Division of Energy Storage Programs (March 1979).
- _____, Budget Highlights, DOE/CR-0004, Office of Controller (March 1979).
- _____, Fission Energy Program of the U.S. Department of Energy, FY 1980, DOE/ET-0089, Office of Nuclear Energy Programs (April 1979).

_____, Nuclear Waste Management Program Summary Document, DOE/ET-0094, Office of Nuclear Waste Management (April 1979).

_____, Magnetic Fusion Program Summary Document, FY 1980, DOE/ET-0107, Office of Fusion Energy (April 1979).

_____, Basic Research Projects, DOE/ER-0028, Office of Basic Energy Sciences (April 1979).

_____, Division of Environmental Control Technology Program - 1978, DOE/EV-0042, Division of Environmental Control Technology (June 1979).

_____, Geothermal Energy - Program Summary, DOE/ET-0101, Division of Geothermal Energy (June 1979).

_____, Solar, Geothermal, Electric and Storage Systems Program Summary Document, FY 1980, DOE/ET-0102, Office of Solar, Geothermal, Electric and Storage Systems (July 1979).

_____, Summaries of Physical Research in the Geosciences, DOE/ER-0030, Division of Basic Energy Sciences (August 1979).

_____, U.S. Department of Energy Environmental Control Symposium, DOE/EV-0046, Division of Environmental Control Technology (September 1979).

_____, Materials Sciences Programs, Fiscal Year 1979, DOE/ER-0031, Division of Materials Sciences (September 1979).

_____, FY 1981 Budget by Appropriation, Computer printout (January 23, 1980).

VI. GLOSSARY

AEC	Atomic Energy Commission
AECT	advanced environment control technology
ANL	Argonne National Laboratory
BCR	Bituminous Coal Research, Inc.
BES	basic energy sciences
BETC	Bartlesville Energy Technology Center
BNL	Brookhaven National Laboratory
BYU	Brigham Young University
CAES	compressed air energy storage
DC	direct current
D&D	decontamination and decommissioning
DOE	Department of Energy
EA	Environmental Assessment
ECT	Environmental Control Technology Division
EHV	extra high voltage
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency
EQ	equipment costs
ET	Office of Assistant Secretary for Energy Technology
EV	Office of Assistant Secretary for Environment
FUSRAP	Formerly Utilized MED/AEC Sites Remedial Action Program
FY	fiscal year
HLW	high-level waste
LASL	Los Alamos Scientific Laboratory
LBL	Lawrence Berkeley Laboratory
LETC	Laramie Energy Technology Center
LLL	Lawrence Livermore Laboratory
LLW	low-level waste
LMFBR	Liquid Metal Fast Breeder Reactor
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MED	Manhattan Engineer District
METC	Morgantown Energy Technology Center
MIT	Massachusetts Institute of Technology
MS	mass spectrometry

NBS	National Bureau of Standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NRC	Nuclear Regulatory Commission
N.Y.ERDA	New York Energy Research and Development Administration
O&A	overview and assessment
ONWI	Office of Nuclear Waste Insulation
OP	operating expenses
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office
OTEC	ocean thermal energy conversion
PACE	plant and capital equipment
PETC	Pittsburgh Energy Technology Center
PL	Public Law
PNL	Pacific Northwest Laboratory
R&D	research and development
RD&D	research, development, and demonstration
REECO	Reynolds Electric and Engineering Company
SRC	solvent refined coal
SRI	Stanford Research Institute
SWRI	Southwest Research Institute
TRU	transuranic waste
UCLA	University of California at Los Angeles
USNWC	United States Naval Weapons Center
WIPP	Waste Isolation Pilot Plant