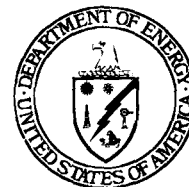


Congressional Budget Request

Energy Supply Research and Development
Nuclear Waste Fund
Isotope Production and Distribution Fund
Basic Research User Facilities

Volume 2

FY 1989



U.S. Department of Energy

Assistant Secretary,
Management and Administration
Office of the Controller
Washington, D.C. 20585

February 1988

DEPARTMENT OF ENERGY
FISCAL YEAR 1989 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
NUCLEAR WASTE FUND
ISOTOPE PRODUCTION AND DISTRIBUTION FUND
BASIC RESEARCH USER FACILITIES

VOLUME 2

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DEPARTMENT OF ENERGY
 FISCAL YEAR 1989 CONGRESSIONAL BUDGET REQUEST
 SUMMARY OF ESTIMATES BY APPROPRIATIONS
 BUDGET AUTHORITY IN THOUSANDS OF DOLLARS

	FY 1987 ACTUAL	FY 1988 ESTIMATE	FY 1989 REQUEST
	-----	-----	-----
APPROPRIATIONS BEFORE THE ENERGY AND WATER DEVELOPMENT SUBCOMMITTEES:			
ENERGY SUPPLY RESEARCH AND DEVELOPMENT..	\$1,258,137	\$1,860,087	\$1,969,760
URANIUM ENRICHMENT.....	1,209,494	950,000	1,184,000
GENERAL SCIENCE AND RESEARCH.....	326,596	355,108	364,986
ISOTOPE PRODUCTION AND DISTRIBUTION FUND	509	89	16,243
BASIC RESEARCH USER FACILITIES.....	473,206	574,945	972,613
ATOMIC ENERGY DEENSE ACTIVITIES.....	7,481,852	7,749,364	8,100,000
DEPARTMENTAL ADMINISTRATION.....	226,874	164,243	177,814
ALASKA POWER ADMINISTRATION.....	2,881	3,026	3,159
BONNEVILLE POWER ADMINISTRATION.....	432,259	165,000	136,000
SOUTHEASTERN POWER ADMINISTRATION.....	19,647	27,400	36,267
SOUTHEASTERN - CONTINUING FUND.....	3,772	---	---
SOUTHWESTERN POWER ADMINISTRATION.....	25,337	16,648	15,389
WESTERN AREA POWER ADMINISTRATION.....	238,008	249,515	298,413
WESTERN AREA POWER EMERGENCY FUND.....	225	24	---
FEDERAL ENERGY REGULATORY COMMISSION....	99,079	100,000	106,760
NUCLEAR WASTE FUND.....	499,000	360,000	448,832
GEOHERMAL RESOURCES DEVELOPMENT FUND....	72	72	75
	-----	-----	-----
SUBTOTAL, APPROPRIATIONS BEFORE THE ENERGY AND WATER DEVELOPMENT SUBCOMMITTEES.....	12,296,948	12,575,521	13,830,311

DEPARTMENT OF ENERGY
 FISCAL YEAR 1989 CONGRESSIONAL BUDGET REQUEST
 SUMMARY OF ESTIMATES BY APPROPRIATIONS
 BUDGET AUTHORITY IN THOUSANDS OF DOLLARS

	FY 1987 ACTUAL -----	FY 1988 ESTIMATE -----	FY 1989 REQUEST -----
APPROPRIATIONS BEFORE THE INTERIOR AND RELATED AGENCIES SUBCOMMITTEES:			
ALTERNATIVE FUELS PRODUCTION.....	437	---	---
CLEAN COAL TECHNOLOGY.....	---	50,000	525,000
FOSSIL ENERGY RESEARCH AND DEVELOPMENT..	293,171	326,975	166,992
NAVAL PETROLEUM AND OIL SHALE RESERVES..	122,177	159,663	185,071
ENERGY CONSERVATION.....	232,362	309,517	89,359
ENERGY REGULATION.....	23,400	21,565	20,772
EMERGENCY PREPAREDNESS.....	6,044	6,172	6,154
STRATEGIC PETROLEUM RESERVE.....	147,433	164,162	173,421
STRATEGIC PETROLEUM ACCOUNT.....	---	438,744	1,017,907
ENERGY INFORMATION ACTIVITIES.....	60,301	61,398	62,856
	-----	-----	-----
SUBTOTAL, INTERIOR AND RELATED AGENCIES SUBCOMMITTEES.....	885,325	1,538,196	2,247,532
SUBTOTAL, ENERGY AND WATER DEVELOPMENT SUBCOMMITTEES.....	12,296,948	12,575,521	13,830,311
	-----	-----	-----
SUBTOTAL, DEPARTMENT OF ENERGY.....	13,182,273	14,113,717	16,077,843
PERMANENT - INDEFINITE APPROPRIATIONS:			
PAYMENTS TO STATES.....	912	1,839	1,909
	-----	-----	-----
TOTAL, DEPARTMENT OF ENERGY.....	\$13,183,185	\$14,115,556	\$16,079,752
	=====	=====	=====

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL STAFFING REQUEST
 TOTAL WORK FORCE

	FY1987 FTE USAGE	FY1988 -FY87	FY1988 CONGR REQ	FY1989 -FY88	FY1989 CONGR REQ
ENERGY & WATER SUBCOMMITTEE					
HEADQUARTERS	4,697	264	4,961	73	5,034
FIELD	9,356	58	9,414	-75	9,339
SUBCOMMITTEE TOTAL	14,053	322	14,375	-2	14,373
INTERIOR SUBCOMMITTEE					
HEADQUARTERS	1,181	66	1,247	-111	1,136
FIELD	882	25	907	-140	767
SUBCOMMITTEE TOTAL	2,063	91	2,154	-251	1,903
GRAND TOTAL	16,116	413	16,529	-253	16,276
ADJUSTMENT		-263	-263	-209	-472
ADJUSTED TOTAL	16,116	150	16,266	-462	15,804

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL STAFFING REQUEST
 TOTAL WORK FORCE

	FY1987 FTE USAGE	FY1988 -FY87	FY1988 CONGR REQ	FY1989 -FY88	FY1989 CONGR REQ
10:ENERGY SUPPLY RESEARCH AND DEV	922	14	936	10	946
HEADQUARTERS	644	7	651	10	661
FIELD	278	7	285	0	285
15:URANIUM ENRICHMENT	59	8	67	0	67
HEADQUARTERS	48	8	56	0	56
FIELD	11	0	11	0	11
20:GENERAL SCIENCE AND RESEARCH	42	-3	39	7	46
HEADQUARTERS	42	-3	39	7	46
25:ATOMIC ENERGY DEFENSE ACTIVITI	2,782	88	2,870	40	2,910
HEADQUARTERS	492	62	554	21	575
FIELD	2,290	26	2,316	19	2,335
30:DEPARTMENTAL ADMINISTRATION	3,333	133	3,466	6	3,472
HEADQUARTERS	1,756	79	1,835	6	1,841
FIELD	1,577	54	1,631	0	1,631
34:ALASKA POWER ADMINISTRATION	36	-1	35	0	35
FIELD	36	-1	35	0	35
36:BONNEVILLE POWER ADMIN	3,398	-18	3,380	-50	3,330
FIELD	3,398	-18	3,380	-50	3,330
38:SOUTHEASTERN POWER ADMIN	38	2	40	0	40
FIELD	38	2	40	0	40
42:SOUTHWESTERN POWER ADMIN	192	-6	186	0	186
FIELD	192	-6	186	0	186
46:WAPA - POWER MARKETING	1,160	-21	1,139	0	1,139
FIELD	1,160	-21	1,139	0	1,139
50:WAPA - COLORADO RIVER BASIN	219	21	240	0	240
FIELD	219	21	240	0	240
52:FEDERAL ENERGY REGULATORY COMM	1,562	97	1,659	0	1,659
HEADQUARTERS	1,562	97	1,659	0	1,659
54:NUCLEAR WASTE FUND	307	8	315	-15	300
HEADQUARTERS	152	14	166	29	195
FIELD	155	-6	149	-44	105
56:GEOTHERMAL RESOURCES DEV FUND	1	0	1	0	1
HEADQUARTERS	1	0	1	0	1
63:CLEAN COAL TECHNOLOGY	0	45	45	13	58
HEADQUARTERS	0	21	21	5	26
FIELD	0	24	24	8	32
65:FOSSIL ENERGY RESEARCH AND DEV	709	-6	703	-133	570
HEADQUARTERS	141	-3	138	-10	128
FIELD	568	-3	565	-123	442
70:NAVAL PETROL & OIL SHALE RES	89	6	95	0	95
HEADQUARTERS	17	5	22	0	22
FIELD	72	1	73	0	73
75:ENERGY CONSERVATION	320	32	352	-109	243
HEADQUARTERS	197	30	227	-84	143
FIELD	123	2	125	-25	100
80:EMERGENCY PREPAREDNESS	64	7	71	0	71
HEADQUARTERS	64	7	71	0	71
81:ECONOMIC REGULATION	288	-13	275	-22	253
HEADQUARTERS	288	-13	275	-22	253
85:STRATEGIC PETROLEUM RESERVE	147	0	147	0	147
HEADQUARTERS	28	-1	27	0	27
FIELD	119	1	120	0	120
90:ENERGY INFORMATION ACTIVITIES	446	20	466	0	466
HEADQUARTERS	446	20	466	0	466
94:ADVANCES FOR CO-OP WORK	2	0	2	0	2
FIELD	2	0	2	0	2
 GRAND TOTAL	 16,116	 413	 16,529	 -253	 16,276
ADJUSTMENT		-263	-263	-209	-472
ADJUSTED TOTAL	16,116	150	16,266	-462	15,804

VOLUME II

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

DEPARTMENT OF ENERGY
FISCAL YEAR 1989 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
VOLUME 2
BIOLOGICAL AND ENVIRONMENTAL RESEARCH
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DEPARTMENT OF ENERGY
FY 1989 CONGRESSIONAL BUDGET REQUEST
OFFICE OF ENERGY RESEARCH

OVERVIEW

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The mission of the Department of Energy (DOE) has brought with it major responsibilities and opportunities in the life sciences. The responsibilities stem from concerns that the energy technologies, which contribute so substantially to the material well being of the American people, may also have adverse health and environmental impacts. The opportunities arise because many of these same technologies, and the intellectual and physical resources underlying their development, have made major contributions to the health and welfare of society, and hold promise for even greater contributions in the future. A central goal of the Biological and Environmental Research (BER) program is to maximize the opportunities of new technologies for the nation while helping to minimize the dangers and adverse affects due to them. One of the extraordinary characteristics of the BER program is its comprehensiveness: the global nature of its scope, compelled by its mission, is unique to the nation and perhaps to the world. This breadth makes it ideally suited to carry out highly complex, long-term, multidisciplinary research programs.

The BER program has two main objectives: (1) to develop the knowledge base necessary to identify, understand and anticipate the long-term health and environmental consequences of energy use and development; and (2) to utilize the Department's unique scientific and technological capabilities to solve major scientific problems in medicine and biology.

Major program activities performed to achieve these objectives include:

- o Biological research to quantify human health risks of exposure to radiation and chemicals via epidemiological studies, with increasing emphasis on molecular, biochemical and cellular endpoints; and research to correlate the relation between local dose, molecular changes and biological responses, especially carcinogenesis and mutagenesis with model cellular and animal systems. Such efforts are contributing to the resolution of: hazards of indoor radon exposure; attributable risk of cancer and genetic damage from radiation and copollutant exposures; risk coefficients for actinides and fission products; impact of Chernobyl fallout, and neutron quality factors for the nuclear industry.

- 0 Life science research emphasizing molecular and cellular studies to elucidate how key biological processes operate, including structural biology to define structure/function relationships of macromolecules so crucial for advances in biotechnology. Another major focus is in molecular genetics to reveal DNA damage and repair mechanisms and to improve tools and methodology for deciphering the nature of the human genome. Success will establish at the genetic level: the basis for individual susceptibility to disease (e.g. cancer, heart disease); the technology to define risks; and the data base for establishing health protection standards. Other technology transfer benefits will also be derived from such research by improving options for environmental waste control, producing and utilizing biomass, agriculture, industrial biotechnology and the diagnosis and treatment of genetic disease.
- 0 Measurement science and dosimetry research to develop new and more sensitive technologies for physical, chemical and biological measurements of energy-related emissions, human exposures and their responses, and for life science and nuclear medicine applications.
- 0 Nuclear medicine research to develop new radioisotopes, labeled compounds, clinical procedures, including neutron capture therapy, and visualization devices for improved diagnosis and treatment of human diseases and the study of human physiological processes, such as brain and heart function. Efforts will begin to develop high field nuclear magnetic resonance spectroscopy for studying metabolic regulation in intact organs and to exploit synchrotron radiation for a safer angiography assay.
- 0 Environmental sciences research to determine the pathways and mechanisms by which energy-related agents move through and are modified by the atmosphere, oceanic and terrestrial ecosystems to impact humans; and to determine how the environment itself may be affected and the impacts mitigated. Issues being addressed include acid rain; carbon dioxide and global climate effects; resiliency of ecosystems and marine coastal areas to energy activities; management of radiation and chemical wastes; and atmospheric and landscape modeling of impacts from energy development in different terrains. Increased effort will be given to defining the role of deep subsurface bacteria for the degradation of chemical wastes, opening the possibility of mitigating buried wastes more effectively and cheaply than current engineering options.

An ongoing effort will be expanded in FY 1989 to develop new information for cost-effective management and remediation of contamination from DOE wastes. Research will: emphasize the development of accurate, noninvasive and inexpensive methods such as fiber optic sensors and seismic tomography to eliminate costly well drilling with its potential for cross contamination of aquifers when assessing subsurface wastes; improve our understanding of the factors influencing mobility of mixed wastes through soil in order that shallow low-level burial sites can be operated more safely and

cost effectively; develop new methods for decontaminating deep surface toxic organic wastes. Hundreds of millions of dollars in anticipated cost benefits in the 1990's can be derived from the information and advanced technologies resulting from this research.

The human genome project, formally initiated by BER in FY 1987, is increasingly being recognized by the scientific community here and abroad as one of modern biology's most significant initiatives. The Department's leading role reflects: the necessary combination of intellectual and physical resources (including engineering, computational and biomedical expertise); the experience and infrastructure for managing high technology, interdisciplinary projects involving national laboratories, universities and industry; and, of course, the mission need for the project's results. The new tools and methodologies to be developed under this project will markedly increase the pace and lower the cost for mapping and sequencing the human genome, saving 1-2 billion dollars and 50-100 years in time over current capabilities. The proposed level of effort will help establish the phased, multidisciplinary collaboration necessary among academia, the private sector and the Department's laboratories. Funding commitments early in the project will realize significant savings later since each advance in technology will make many of the following steps more efficient and less costly. Even as the project progresses, the benefits derived from the applications of the interim progress will dwarf in value the project investments.

Carbon dioxide and the greenhouse effect linked to global climate change has become a national and international science and energy policy issue and is emerging as a major issue. Additional funds are requested in FY 1989 for policy analysis research and joint model intercomparison, cloud and ocean research activities. Policy analysis activities are required to investigate the potential carbon dioxide reduction through energy strategic planning and to identify regions in jeopardy and potential affects on resources such as forests and agriculture.

A boron neutron capture therapy (BNCT) program at Idaho National Engineering Laboratory (INEL) was initiated in DOE in FY 1988 and activities will continue in FY 1989. The National Institute of Health/National Cancer Institute (NIH/NCI) is currently performing a review of BNCT at INEL and, within the next few months, will make recommendations concerning the direction the DOE program should take. The final plans for the program will be based on the NIH/NCI findings

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL BUDGET REQUEST
 OFFICE OF ENERGY RESEARCH
 (Dollars in Thousands)

LEAD TABLE
 Biological and Environmental Research

Activity -----	FY 1987 Actual -----	FY 1988 Approp. -----	FY 1989 Base -----	FY 1989 Request -----	Program Change Request vs Base	
					Dollar -----	Percent -----
Biological and Environmental Research.....	\$173,018	\$200,585	\$200,585	\$232,500	\$ +31,915	+ 16%
Program Direction.....	3,600	4,000	4,000	4,000	0	--
Capital Equipment.....	8,500	8,500	8,500	9,000	+ 500	+ 6%
Construction.....	6,000	56,200	56,200	3,500	- 52,700	- 94%
Total.....	\$191,118 a/b/	\$269,285 b/c/	\$269,285 b/	\$249,000 b/	\$ -20,285	- 8%
Operating Expenses.....	(\$176,618)	(\$204,585)	(\$204,585)	(\$236,500)	\$ +31,915	+ 15%
Capital Equipment.....	(8,500)	(8,500)	(8,500)	(9,000)	+ 500	+ 6%
Construction.....	(6,000)	(56,200)	(56,200)	(3,500)	-52,700	- 94%
Staffing Total FTE's						
Headquarters.....	53	55	55	55	--	--
Field.....	86	87	87	87	--	--
Total.....	139	142	142	142	--	--

Authorization: Section 103, P.L. 93-438, Section 203, P.L. 95-91.

a/ Total has been reduced by \$2,087,000 which has been transferred to SBIR.

b/ Total has been reduced by \$860,000 in FY 1987, \$915,00 in FY 1988 and \$890,000 in FY 1989 to reflect transfer of isotopes activities to the Isotope Production and Distribution Fund.

c/ Total includes \$5,000,000 transferred from Nuclear Energy for boron neutron capture therapy.

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL BUDGET REQUEST
 ENERGY SUPPLY RESEARCH AND DEVELOPMENT
 (dollars in thousands)

SUMMARY OF CHANGES

Biological and Environmental Research

FY 1988 Appropriation.....	\$269,285
- Continue radiation and chemical dosimetry, sustain measurement technology and instrumentation.....	+ 1,653
- Sustain, field and laboratory studies on transport and transformation of radionuclides, organics, and trace elements through atmospheric, terrestrial and aquatic media.....	+ 1,556
- Enhance efforts in defining the role of deep subsurface bacteria for the degradation of chemical wastes.....	+ 7,000
- Maintain epidemiologic, biological markers studies, and long-term experimental animal research on radiation and complex chemical mixtures.....	+ 3,287
- Initiate decontamination and decommissioning of University of California, Davis Laboratory for Energy Related Health Research.....	+ 3,200
- Expand structural biology research; continue research in molecular genetics, cell biology, and chemical physics.....	+ 4,027
- Maintain efforts on nuclear medicine feasibility studies and related instrumentation..	+ 285
- Sustain carbon dioxide research program to reduce uncertainties concerning the effects of increased atmospheric CO ₂ , expand programs for policy analysis and research concerning the global climate change issue.....	+ 3,624

- Accelerate efforts on mapping the entire human genome.....	+ 7,283
- Maintain capital equipment and general plant projects support for program needs.....	+ 1,000
- No provision for funding of Congressional initiated university construction projects in FY 1988.....	<u>-53,200</u>
FY 1989 Congressional Budget Request.....	\$249,000

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL BUDGET REQUEST
 ENERGY SUPPLY RESEARCH AND DEVELOPMENT
 (dollars in thousands)

KEY ACTIVITY SUMMARY

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

I. Preface: SOURCE AND DOSE DETERMINATION

Population exposure underlies both the development of risk coefficients and an assessment of projected health impacts. This exposure may be estimated by characterization of the radiation or chemical source combined with the application of suitable mathematical models which compute the exposure of the receptor population. Alternatively, exposure may be determined by direct measurement using appropriate personnel or area monitoring instrumentation. The source and dose determination program develops and evaluates the instrumentation and computational technology required to address this responsibility.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Analytical Studies.....	\$ 4,155	\$ 3,425	\$ 3,403	- 1
Dosimetry Research.....	3,426	4,931	6,433	+ 30
Measurement Science.....	6,062	7,665	7,838	+ 2
Total, Source and Dose Determination.....	\$ 13,643	\$ 16,021	\$ 17,674	+ 10

II. B. Major Laboratory and Facility Funding

Ames Laboratory.....	\$ 584	\$ 503	\$ 599	+ 19
Argonne National Laboratory....	755	627	750	+ 20
Brookhaven National Laboratory.	49	92	100	+ 9
Lawrence Berkeley Laboratory...	1,543	1,557	1,793	+ 15
Lawrence Livermore Nat. Lab....	499	354	476	+ 34
Oak Ridge National Laboratory..	2,683	2,691	3,064	+ 14
Pacific Northwest Laboratory...	1,106	1,227	1,378	+ 12
Environmental Measurements Lab.	3,925	4,061	4,184	+ 3
Total.....	\$ 11,144	\$ 11,112	\$ 12,344	+ 11

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
SOURCE AND DOSE DETERMINATION			
Analytical Studies	<p>Analytical characterization of chemical mixtures in support of chemical toxicology research was completed. Worldwide radiological characterization studies were maintained. In cooperation with the IAEA, materials containing Chernobyl debris were measured and the radionuclide contamination determined. A Chernobyl data base was established to provide evaluated data for scientific purposes. (\$4,155)</p>	<p>Radiological characterization studies will be sustained. The Chernobyl data base activity will interact with the scientific community to provide data for the purpose of testing, validating, and enhancing environmental transport computational models. (\$3,425)</p>	<p>Sustain radiological characterization and Chernobyl data base activities. (\$3,403)</p>
Dosimetry Research	<p>Continued planned phase down of Japanese dosimetry reassessment effort. Chemical dosimetry studies emphasized development of techniques for measuring DNA adducts. Radiation research focused on neutron dosimetry and techniques for other high LET radiation such as alpha particles from radon and radon daughters. (\$3,426)</p>	<p>Redirect Japanese dosimetry activity to development of advanced methodology applicable to occupational health protection. Continue development of techniques and methodology for assessing chemical exposure. Enhance radon research with emphasis on studies of the physical mechanisms of high LET radiation interaction with biomolecules and on development of improved exposure-dose concepts for critical targets. (\$4,931)</p>	<p>Maintain radiation and chemical dosimetry research with emphasis on mixed field radiation dosimetry techniques and methodology for DNA adduct measurement. Continue extension of advanced external dosimetry computational techniques to occupational health applications. Sustain radon research for development of better dosimetric concepts; improved exposure-dose relationships; enhanced definition of radon availability, distribution and migration in the indoor environment; and a more refined understanding of high LET interactions with biomolecules. (\$6,433)</p>

III. SOURCE AND DOSE DETERMINATION (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Measurement Science	The measurement science program continued basic research in development of new instrumentation and techniques for detection of radiation, measurement of toxic materials and analysis of biological molecules. By combining highly selective laser ionization techniques with mass spectrometry, sensitivity for measurement of atoms and isotopes was improved by several orders of magnitude. A new technique using a sharply focused neutral beam microprobe for characterizing biological specimens was demonstrated. (\$6,062)	Continue development of advanced measurement technologies. New approaches to development of positron sensitive radiation detectors using amorphous semiconductor materials will be explored. Such detectors would have important applications in radiation monitoring and medical imaging. Research will be initiated on advanced instrumentation to separate and quantitatively measure complex biological materials using a laser scanning and imaging technique. (\$7,665)	Sustain measurement technology and instrumentation development research. Continue development of advanced laser techniques for sensitive and selective chemical measurements. Maintain a focus on biologically active materials and detection of damage to biological systems. Complete development of instrumentation to measure primary biomass production in the oceans. (\$7,838)
Total Source and Dose Determination	\$13,643	\$16,021	\$17,674

I. Preface: ENVIRONMENTAL PROCESSES AND EFFECTS

Upon release of agents from an energy source, it becomes necessary to understand their transport and transformation through atmospheric, terrestrial and marine media in order to estimate the subsequent exposure to humans and the environment. This research activity dates from the early weapons testing era when information on the transport and fate of fallout radionuclides was needed. To meet this need, a comprehensive program in the physical and ecological sciences was established which today is being utilized to address a multitude of environmental concerns. Increased emphasis will be placed on microbial ecology to understand mechanisms for transport of radionuclides and degradation of organic chemical contaminants and on radon transport in soil and groundwater systems.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Atmospheric.....	\$ 12,061	\$ 11,238	\$ 12,719	+ 13
Marine.....	5,367	5,360	7,075	+ 32
Terrestrial/Aquatic.....	6,911	8,096	13,018	+ 61
Ecosystem Response.....	7,425	7,715	8,153	+ 6
Total, Environmental Processes and Effects.....	\$ 31,764	\$ 32,409	\$ 40,965	+ 26

II. B. Major Laboratory and Facility Funding

Argonne National Laboratory....	\$ 1,276	\$ 1,388	\$ 1,409	+ 2
Brookhaven National Laboratory.	4,467	4,683	4,687	--
E.I. DuPont DeNemours.....	547	557	465	- 17
Fermi National Laboratory.....	50	40	50	+ 25
Lawrence Berkeley Laboratory...	294	632	810	+ 28
Lawrence Livermore Nat. Lab....	1,314	1,284	1,378	+ 7
Los Alamos National Laboratory.	1,817	1,759	1,604	- 9
Oak Ridge National Laboratory..	2,334	2,273	2,308	+ 2
Pacific Northwest Laboratory...	5,934	6,207	6,478	+ 4
Environmental Measurements Lab.	2,043	2,106	2,190	+ 4
Georgia, University of.....	797	580	590	+ 2
Total.....	\$ 20,873	\$ 21,509	\$ 21,969	+ 2

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
ENVIRONMENTAL PROCESSES AND EFFECTS			
Atmospheric	Within the framework of the National Acid Precipitation Assessment Program (NAPAP) the Atmospheric Sciences program contributes primarily to the study of pollutant scavenging by	A major field study of cloud and precipitation processing of pollutants by convective storm systems will be undertaken. It will be conducted in conjunction with	The final field study of cloud and precipitation processing of pollutants will take place with emphasis on frontal and primarily nonconvective large scale systems.

III. ENVIRONMENTAL PROCESSES AND EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Atmospheric (Cont'd)	<p>clouds and precipitation. The multi-laboratory Program PRECP (Processing of Emissions by Clouds and Precipitation) conducts field experiments for a variety of storm systems and geographical locations using several measurement platforms, develops diagnostic models for the quantification of the deposition processes, as well as supports laboratory investigations of the dominant chemical mechanisms. The MAP3S network continues to provide high quality wet deposition data regionally representative of the eastern U.S. The data base is starting to contribute to a better understanding of trends and spatial patterns. Dry deposition research continues to advance the understanding of the fundamental physical and chemical mechanisms of this pathway. (\$6,163)</p> <p>The Atmospheric Studies in Complex Terrain (ASCOT) Program continues to advance the state-of-the-science of dispersion in mountainous conditions. Processing of data from a large field experiment conducted during FY 1986 is contributing to improved characterizations of the</p>	<p>other NSF-sponsored cloud physics experiments for optimum utilization of resources and the available scientific expertise. This PRECP field effort is also being coordinated with the EPA-sponsored large scale field study for the verification of the NAPAP acid deposition models. PRECP will also continue development of the wet scavenging module for the NAPAP models as well as the laboratory investigations of the relevant chemical mechanisms. Some invigoration of the MAP3S research network will take place after an assessment of the network's expanded role in model evaluation. An enhancement of the network's instrumentation is likely. Dry deposition research will continue at the previous FY level. (\$6,239)</p> <p>A modest field effort will be undertaken by ASCOT to reduce certain key modeling uncertainties. A principal ASCOT activity will be the consolidation of the major scientific advances with the publication of a scientific journal volume dedicated to the presentation of these</p>	<p>This experimental effort is also coordinated with the EPA sponsored field measurements for the verification of the acid deposition models. Development of the wet scavenging module for the acid deposition models will be completed and delivered to the modeling task group. Laboratory simulations of the dominant chemical mechanisms will continue for further improvement of the chemical kinetics parameterizations. The task of synthesis of the major PRECP accomplishments coupled with a concise deposition climatology will commence. The upgraded MAP3S research network will continue operations. Analytical studies exploring source/receptor relationships with the use of the MAP3S data will be initiated. Dry deposition research activity will remain level. (\$6,408)</p> <p>Transport and dispersion research by ASCOT will move to a larger mountain-valley system to explore the tie-ins of local circulations to more regional weather systems. Experimental limitations due to enhanced spatial scales will be compensated by more elaborate</p>

III. ENVIRONMENTAL PROCESSES AND EFFECTS (Cont'd)

Atmospheric (Cont'd)

dominant dynamical mechanisms. As a result, the mathematical models simulating the transport and diffusion of pollutants in complex terrain are gaining in accuracy and credibility. The use of atmospheric tracers remains a valuable experimental technology which was applied in a major DOD experimental effort. Other activities in model development and verification have dealt with emergency response to accidental atmospheric releases. (\$3,234)

A number of individual research efforts are exploring key physical and chemical processes in the atmosphere and the laboratory. These include the investigation of primary and secondary organics in the atmosphere and their photochemical oxidation role, gas-to-particle conversion, and heterogeneous chemical reactions. Advances in the development of the tracer technology have created important new research capabilities such as for indoor pollution. Attempts are made to integrate several of the individual research efforts into a comprehensive atmospheric chemistry program. (\$2,664)

advances. Certain modeling activities will be geared toward streamlining ASCOT models for assessment purposes such as for Emergency Response and the study of visibility deterioration in the West. Other emergency response activities will include a modest field study of dispersion in the stable atmospheric boundary layer. (\$2,600)

Primary and secondary organic compounds in the atmosphere will be studied during field studies "of opportunity" (such as the PRECP program's field studies) and in the laboratory. The role and influence of biogenic organic emissions in atmospheric chemistry will be assessed. Participation by some laboratory programs in a major southern California air quality study will take place. Research on gas-to-particle conversion and heterogeneous reactions will continue. The tracer technology will be applied to oil-drilling applications. Several problems related to the dispersion of radionuclides in the atmosphere will be researched. (\$2,399)

modeling parametric studies. Emergency response research activities will concentrate on the incorporation of a forecasting dimension to the Atmospheric Release Advisory Capability (ARAC) system. (\$3,000)

The study of organic compounds in the atmosphere will continue with field measurements taken in conjunction with the PRECP field efforts. Laboratory studies of fundamental chemical processes along with applications of the tracer technology will be pursued. (\$3,311)

Total Atmospheric

\$12,061

\$11,238

\$12,719

III. ENVIRONMENTAL PROCESSES AND EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Marine	<p>Conduct research to understand transport of introduced energy and weapons materials in the oceanic regions along the eastern and south western areas of the U.S. and the interactions of the coastal water masses with the open ocean to predict fate of these materials especially pathways back to humans and providing basic information to such efforts as retrieval of the Challenger booster rocket off Cape Canaveral (\$5,367)</p>	<p>Phase II of the Shelf Edge Exchange Program (SEEP) in the Northeast will begin its field year in February 1988 through January 1989 to determine dynamics of transport from the Northeast to the Cape Hatteras area where it appears there is entrainment of material in the Gulf Stream current. The California Basin program (CABS) will complete its final year of data gathering and begin data synthesis. The Southeast program will continue to focus on flushing rates of materials from the continental shelf (\$5,360).</p>	<p>Complete field work in SEEP and begin to synthesize data in SEEP and CABS. Begin to implement a multiagency global program where the on-going BER marine research will become a central focus of the ocean margins research to understand global implication of interaction between the deep ocean waters and coastal inputs. (\$7,075)</p>
Total Marine	\$5,367	\$5,360	\$7,075
Terrestrial/Aquatic	<p>Continue research at DOE sites on physical, chemical and biological characteristics which control movement of toxic wastes through soils and groundwater to better predict behavior and develop understanding for cost effective, safe, longterm disposal of DOE wastes. Exploit discovery in 1986 by this program of extensive populations of microorganisms at depths to 1000 ft. for possible in-situ cleanup of contaminated ground water (\$6,452). Initiate research on radon in the environment. (\$459)</p>	<p>Maintain research in contaminant transport in soils and groundwater. Extend deep microbiology research to an additional site near Savannah River to evaluate abundance and types of organisms under different geologic conditions and begin to predict where and how the microorganisms work best to break down toxic substances in the subsurface. (\$6,170) Expand research in characteristics of radon discharges from the environment. (\$1,926)</p>	<p>Continue research in environmentally related radon studies to determine aspects of soil types, depth and porosity to radon levels, as well as humidity and moisture factors. (\$2,157) Develop accurate, noninvasive, inexpensive methods including fiber optic sensors, seismic tomography and aerial imagery to eliminate need of drilling costly wells for monitoring. Eliminate program in satellite remote sensing of surface contaminants. (\$2,361) Expand deep microbiology research to two additional sites (one in western</p>

III. ENVIRONMENTAL PROCESSES AND EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Terrestrial/Aquatic (Cont'd)			U.S., one in eastern U.S.) in several different groundwater regimes, one having organic chemical contamination, another with radionuclide contamination. Strengthen research in understanding capacity of natural soils and subsurface systems to degrade and transport organic chemicals. Begin development of expert systems for mixed wastes of organics, radionuclides and trace metals through soils and subsurface systems by targeting on unifying concepts. (\$8,500)
Total Terrestrial/Aquatic	\$ 6,911	\$ 8,096	\$13,018
Ecosystem Functioning and Response	Continue in federal lead for innovative landscape modeling linking atmospheric and terrestrial time and space scales to determine effects of disturbance (as on DOE sites) to regional and global systems. Concentrate on field studies at DOE sites designated as National Environmental Research Parks and in the Arctic North Slope to evaluate resiliency of these ecosystems to selected impacts of energy related	Complete three year field study on Arctic North Slope and begin to analyze and synthesize data on impacts of energy-related disturbance on a tundra ecosystem. Focus effort on development of closely integrated research program in arid ecosystems (Los Alamos, Hanford, and Idaho) to anticipate needs and problems related to arid lands where much of future energy development will take place. Focus	Continue momentum in complex ecosystem modeling utilizing advanced computer systems. Complete Phase I of Arctic tundra study and begin development of next phase of program in collaboration with other agencies (NASA, NOAA, NSF) to broaden coverage of Arctic North Slope ecosystems. Develop integrated arid ecosystem program at DOE desert sites targeted on water balance and atmospheric/land interactions.

III. ENVIRONMENTAL PROCESSES AND EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Ecosystem Functioning and Response (cont'd)	activities. Continue to determine physiologic and genetic limits of tolerance and adaptation of individual organisms and populations to stresses from energy impacts. (\$7,425)	environmental physiology program to concentrate on genetic adaptability of plants and animals exposed to energy and weapons related materials. (\$7,715)	Continue other field programs in the network of DOE National Environmental Research Parks and physiologic studies to determine adaptability and resiliency of plants and animals to DOE activities. (\$8,153)
Total Ecosystem Functioning and Response	\$ 7,425	\$ 7,715	\$ 8,153
Total Environmental Processes and Effects	\$31,764	\$32,409	\$40,965

I. Preface: HEALTH EFFECTS

The Health Effects research program provides a continuing source of information needed to ensure that the operations and policies of the Department can be supported in terms of protecting the health of workers and the general public. Research in this program is designed to meet that responsibility by the development of a broad, scientifically sound data base for evaluating the potentially adverse health effects that could result from exposures to radiation and chemical agents most relevant to Department of Energy programs. One subprogram utilizes human epidemiological data obtained from selected human populations known to have been acutely exposed to moderately high, or to chronically low levels of external radiation, internally deposited radioactive materials, or energy-related materials. The other subprogram is designed to provide detailed health effects data, including data on mechanisms by which health effects are induced and expressed, which cannot be obtained from human studies. This subprogram makes use of experimental animals, as they are useful models for human beings. In addition, animal organ and tissue cultures, as well as animal and human cell cultures, are extensively used. Both subprograms will increasingly emphasize molecular-level studies. There is also a small subprogram in radiation biophysics.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
-----	-----	-----	-----	-----
Health Effects				
Human Health				
RERF Epidemiology.....	\$ 13,000	\$ 15,500	\$ 17,000	+ 10
DOE Workers Epidemiology....	4,146	4,282	4,924	+ 15
Other Epidemiology.....	4,065	3,577	4,168	+ 17
Radon Related Studies.....	1,985	1,791	2,008	+ 12
	-----	-----	-----	-----
Subtotal, Human Health.....	\$ 23,196	\$ 25,150	\$ 28,100	+ 12
Health Effects/Biological				
Radiation Biology.....	\$ 24,022	\$ 28,194	\$ 32,086	+ 14
Chemical Toxicology.....	8,480	7,089	6,700	- 5
	-----	-----	-----	-----
Subtotal, Health Effects/ Biological.....	\$ 32,502	\$ 35,283	\$ 38,786	+ 10
Radiological Physics.....	3,825	3,770	3,804	+ 1
	-----	-----	-----	-----
Total, Health Effects.....	\$ 59,523	\$ 64,203	\$ 70,690	+ 10

II. B. Major Laboratory and Facility Funding

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Argonne National Laboratory....	\$ 6,790	\$ 6,395	\$ 7,115	+ 1
Brookhaven National Laboratory.	1,526	1,525	1,425	- 7
Lawrence Berkeley Laboratory...	1,753	1,878	1,828	- 3
Lawrence Livermore Nat. Lab....	1,609	1,610	1,550	- 4
Los Alamos National Lab.....	1,357	1,682	2,016	+ 20
Oak Ridge National Laboratory..	7,914	5,485	7,356	+ 34
Pacific Northwest Laboratory...	5,879	5,397	5,256	- 3
California, Univ. of at Davis..	864	191	3,725	+1850
California, Univ. of at San Francisco.....	544	481	719	+ 49
Inhalation Toxicology Research Institute.....	6,155	7,507	8,290	+ 10
Oak Ridge Associated Univ.....	3,605	3,847	4,003	+ 4
Utah, University of.....	1,316	280	200	- 29
NAS/Radiation Effects Research Foundation, Japan.....	13,000	15,500	17,000	+ 10
Total.....	\$ 52,312	\$ 51,778	\$ 60,483	+ 17

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
HEALTH EFFECTS			
Human Health Research RERF Epidemiology	Research at the Radiation Effects Research Foundation involves epidemiologic, dosimetric, and clinical studies of Japanese atomic bomb survivors and offspring. (\$13,000)	Changes in the dollar:yen exchange rate require additional funds to maintain ongoing studies in Hiroshima and Nagasaki. (\$15,500)	Continue studies of atomic bomb survivors and offspring. (\$17,000)

III. HEALTH EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Epidemiologic Studies of DOE Workers	Continue studies of DOE workers at various facilities. Studies at some facilities and studies of some subpopulations are completed and results published in the scientific literature. (\$4,146)	Pooling of data across facilities, occupations, and diseases of interest, receives increased priority in DOE worker studies. (\$4,282)	Data pooling efforts reach conclusion as studies expand to additional facilities not previously studied. (\$4,924)
Other Epidemiology Studies	Continue studies of nuclear shipyard workers and radium dial painters. Maintain ecologic database development and uranium/transuranium registries. (\$4,065)	Shipyards workers study reaches conclusion. Initiate case-control studies of shipyard workers, as necessary. Continue studies of radium dial painters. Maintain ecologic database development and uranium/transuranium registries. (\$3,577)	Initiate molecular epidemiology, studies of ionizing radiation, magnetic resonance imaging, alternative energy sources, energy conservation, nuclear medicine procedures, using molecular and biochemical epidemiologic endpoints. (\$4,168)
Radon Related Studies	Continue studies of lung cancer related residential radon exposure in Pennsylvania, and of uranium miners in New Mexico. (\$1,985)	Continue radon studies in Pennsylvania. Initiate model development of human lung deposition studies of children, women, and males related to patterns of inhaled radon at various concentrations of attached and unattached fractions. These will be used for dosimetric calculations as well as providing data to validate prior and ongoing studies. Complete study of New Mexico uranium miners. (\$1,791)	Continue radon studies in Pennsylvania. Continue lung deposition studies and begin application of data previously obtained. (\$2,008)
Total Human Health Research	\$23,196	\$25,150	\$28,100

III. HEALTH EFFECTS (Cont'd)

Program Activity

Health Effects/Biological
Radiation Biology

FY 1987

Continued long-term carcinogenesis studies in animals exposed to radionuclides or external radiation. Began process of integrating and consolidating two long-term studies of radionuclide toxicity in dogs. Continued studies of oncogene relationships in radionuclide-induced tumors in dogs. Mechanistic leukemogenesis studies in gamma-irradiated dogs were continued as was work on the collection of dose-response data for tumor induction in mice by heavy charged particles. A study of neutron induction of myelogenous leukemia in mice was initiated. Three new projects were initiated to increase knowledge of health effects associated with exposure to radon and its daughter products. (\$13,242)

No activity.

FY 1988

Maintain long-term studies of radiation carcinogenesis in dogs and rodents except for the neutron leukemogenesis study, which will be accelerated. Increase ongoing oncogene studies as well as research on tumor initiation and promotion in irradiated animals. Complete arrangements for the consolidation of two long-term dog studies. Develop new methods for modeling experimental animal data including extrapolation of tumor data to human health effects. Begin new research initiative to develop improved understanding of the biological basis for tumor induction in the respiratory tract by radon and its radioactive decay products. (\$16,740)

No activity.

FY 1989

Continue radiation carcinogenesis studies with a decrease in overall level of effort. Continue long-term animal research and related mechanistic studies. Continue studies of radon/radon daughter effects on the respiratory tract and in experimental model systems. Continue redirection of radiation carcinogenesis research toward increasing emphasis on cellular and molecular mechanistic approaches. (\$15,965)

Funding for initiation of environmental cleanup activities at the University of California, Davis (UCD) will be provided. Termination of the Management and Operating contact with UCD is scheduled for the end of FY 1989. Transfer of title to DOE-owned facilities requires decontamination and decommissioning of the site, which is estimated to cost approximately

III. HEALTH EFFECTS (Cont'd)

Program Activity

FY 1987

FY 1988

FY 1989

Health Effects/Biological
Radiation Biology (Cont'd)

The ORNL mouse genetics project continued with a significant increase in research aimed at mapping at the molecular level selected, well characterized heritable germ-line mutations. Genetics research on the Japanese atomic bomb survivors was expanded with a study of measurable stable hematopoietic stem cell mutations expressed as altered red cell membrane molecules in irradiated individuals. Research on the morphology, biochemistry, and cytogenetics of spermatogonia showed definite changes due to radiation and suggested that mutations might be detectable in these cells. New insights were gained into mechanisms of DNA damage and repair by both high- and low-LET radiations. (\$10,780)

Emphasize the analysis of selected heritable germ line mutations in irradiated mice using state-of-the-art recombinant DNA techniques. Bring closer to completion the definitive report on spontaneous and possible radiation-induced heritable mutations in the Japanese A-bomb survivors and further develop the database of human DNA-repair capabilities as an indicator of individual radiation sensitivity. Continue multispecies comparative research on the induction of DNA damage by high- and low-LET radiations. Sustain work on the cytogenetics of chromosome damage. Initiate research on radon-induced gene damage as a key event in the initiation of tumorigenesis in the respiratory tract. (\$11,454)

\$17,000,000 upon completion in the next three years. Initial FY 1989 funding will allow cleanup of Sr-90 trenches, sludge, leach fields and spetic tanks. (\$3,200)

Continue research on the molecular biology of radiation-induced heritable mutations in mice and on somatic mutations in human skin and blood cells. Sustain research on radiation-induced DNA damage and repair. Continue studies of the role of radon-induced gene damage in relation to the initiation of tumor development. Develop new and improved molecular and cellular based systems to measure possible radiation-induced somatic and heritable mutations in human populations. (\$12,921)

Total Radiation
Biology

\$24,022

\$28,194

\$32,086

III. HEALTH EFFECTS (Cont'd)

Program Activity

Health Effects/Biological
Chemical Toxicology

FY 1987

The chemical toxicology program was redirected to increase emphasis on fundamental, mechanistic research of broad applicability. Electrophoretic methods have been shown to be particularly valuable for the rapid identification of chemical-induced heritable mutations. Significant advancements have been made in understanding the molecular regulation of cell differentiation and how such regulation is related to carcinogenesis; this work involved examination of oncogene activation and growth factor influences. Important information on both the extent to which xenobiotics are metabolized in the respiratory tract and the identification of cell types responsible for metabolic changes, and their locations, has come from multilevel animal studies as has information on the biological effects of metals. Teratogenic effects were demonstrated to occur very early in pregnancy, prior to implantation, an exposure period not previously considered to be of biological importance. Development of monoclonal antibody procedures for detection of toxicants have proven

FY 1988

Mechanistic research based on cellular and molecular approaches will be increasingly emphasized. Future activities will focus on single chemicals and simple mixtures of chemicals in well-characterized model systems. Fundamental research on mechanisms of synergistic and antagonistic interactions will be continued using well defined mixtures. Studies of the molecular and cellular basis of events leading to cancer including the genetic control of procarcinogen activation, metabolism of compounds by relevant tissues, formation of DNA adducts, cellular oncogene activation, and tumor promotion will continue. Ongoing studies to define the basis of chemical-induced genetic effects will be supported. Studies involving the absorption and biotransformation of chemicals will also be continued with an emphasis on the respiratory tract. (\$7,089)

FY 1989

Fundamental investigations that elucidate general principles relative to the toxic manifestations of chemicals will be emphasized. It is anticipated that much of this research will be at the cellular/molecular level employing novel in vitro and in vitro-in vivo systems. There will be a continued strong interest in carcinogenesis as a general endpoint and in the respiratory tract as the route of exposure. Where appropriate, multilevel research, in which cellular and molecular events will be related to responses in the whole animal, will be conducted. Selected efforts in initiation (e.g., DNA adduction) and progression (e.g., cell regulation, promotion, etc.) of tumorigenesis will be sustained. Mouse genetic studies will be increasingly focused on molecular mechanisms and less on classical genetics. Overall, there will be a decrease in level of research effort. (\$6,700)

II. HEALTH EFFECTS (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Health Effects/Biological Chemical Toxicology (Cont'd)	successful as have efforts directed at understanding the role of immunological reactions in the production of toxic responses such as berylliosis. (\$8,480)		
Total Chemical Toxicology	\$8,480	\$7,089	\$6,700
Total Health Effects/ Biological	\$32,502	\$35,283	\$38,786
Radiological Physics	Emphasis was placed on strengthening the interface between radiation biophysics and molecular biology. Low energy x-ray studies were pursued which provide a distinct insight into the mechanisms of action of ionizing radiation with biological material. (\$3,825)	Continue radiation biophysics research emphasizing further development of radio- biological response models. Investigate the mechanisms of energy transfer from the physical stage to the chemical stage of radiation interaction with biological molecules. Maintain efforts to strengthen the coupling between radiation biophysics and molecular biology. (\$3,770)	Maintain radiation biophysics research to obtain insights into the basic mechanisms of radiation interactions with matter. Apply this understanding to the interpretation of radiobiological response. Emphasize the extrapolation of gas phase data to the condensed phase. Initiate theoretical studies on conformation and configuration changes in model systems produced by interaction with physical and chemical agents. (\$3,804)
Total Health Effects	\$59,523	\$64,203	\$70,690

I. Preface: GENERAL LIFE SCIENCES

Research in General Life Sciences contributes to the base of fundamental biological knowledge that is required for the effective study and interpretation of energy-related health effects. It also identifies early indicators of biological damage, develops new techniques and experimental systems for research use, and provides knowledge that eventually becomes used in the estimation of human health risk. Research in this category also supports the development of new instruments to analyze biological systems and the use of special facilities at the National Laboratories, such as neutron sources for the determination of biological structure, and state-of-the-art capabilities in scanning transmission electron microscopy, that are heavily used by the academic community for research and training. This research area will provide additional support to accelerate mapping of the entire human genome by improving the DNA-sequencing technology, developing new instrumentation and applying robotics technology where possible.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
-----	-----	-----	-----	-----
Structural Biology.....	\$ 5,091	\$ 5,442	\$ 8,000	+ 47
Molecular Biology.....	17,699	22,848	28,070	+ 23
Cell Biology.....	5,553	4,513	4,644	+ 3
Chemical Physics.....	4,943	6,948	10,347	+ 49
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Total, General Life Sciences.....	\$ 33,286	\$ 39,751	\$ 51,061	+ 28

II. B. Major Laboratory and Facility Funding

Ames Laboratory.....	\$ 0	\$ 137	\$ 150	+ 9
Argonne National Laboratory....	1,382	1,312	1,423	+ 8
Brookhaven National Laboratory.	5,158	5,181	5,626	+ 9
Lawrence Berkeley Laboratory...	1,914	2,237	2,738	+ 22
Lawrence Livermore Nat. Lab....	4,171	4,334	4,549	+ 5
Los Alamos National Laboratory.	5,612	6,417	6,930	+ 8
Oak Ridge National Laboratory..	5,713	5,739	5,726	--
Pacific Northwest Laboratory...	150	0	340	--
California, Univ. of, at				
San Francisco.....	2,291	2,242	2,385	+ 6
Oak Ridge Associated Univ.....	491	550	515	- 6
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Total.....	\$ 26,882	\$ 28,149	\$ 30,382	+ 8

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
GENERAL LIFE SCIENCES			
Structural Biology	<p>Completed instrumentation of the x-ray beam line at the National Synchrotron Light Source so that research in structural biology at this facility can now utilize both the vacuum ultraviolet and x-ray capabilities. Completed the initial instrumentation of the pulsed neutron source and began studies of biological materials. Improvements in the analysis of proteins by gel electrophoresis will make it easier to detect rare mutational events. (\$5,091)</p>	<p>Expand the neutron scattering facility developed at the High Flux Beam Reactor to include additional small angle stations for the study of subcellular biological complexes. Develop advanced NMR spectroscopy for the analysis of biological structures making use of facilities for labeling biological molecules with tritium. Initiate research at the LANL pulsed neutron source, including research on the structure of chromosomes and their constituent parts. Examine and evaluate possible plans to initiate a Center for Molecular Biotechnology at BNL to use laboratory, university, and industrial facilities for structural work in a coordinated way.(\$5,442)</p>	<p>Continue ongoing studies in structural biology. Develop at the National Synchrotron Light Source an extremely intense non-monochromatic x-ray beam for special applications in protein crystallography. Develop a coordinated Structural Biology Program at LBL to bring together investigators to study new problems in structural molecular biology and catalysis. (\$8,000)</p>
Molecular Biology	<p>Research focused on the molecular nature and quantitation of somatic and germ-cell mutations that are induced by ionizing radiation in mammals. The majority of radiation-induced mutations in mice were found to involve insertions of retroviruses in the affected gene. After providing to the scientific community complete collections of relatively small DNA fragments from human chromosomes, the National Laboratory Gene Library Project started to</p>	<p>Emphasis will continue on research aimed at deciphering the mechanisms of gene damage and repair, mutation and expression in mammalian somatic and germ cells. Production of the larger human chromosome-specific DNA fragments in the Gene Library Project will be continued. The effort to develop and apply technologies for preparation of ordered DNA fragments of human chromosomes will be significantly expanded. New concepts and techniques for sequencing DNA</p>	<p>Continue molecular characterization of DNA damage from radiation and of the genes coding for DNA repair with particular emphasis on characterizing the molecular mechanisms and controlling factors in human DNA repair; continue the production and application of human chromosome-specific gene libraries; continue research on the structure and function of genes and chromosomes. Substantially accelerate the development of linearly ordered sets</p>

III. GENERAL LIFE SCIENCES (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Molecular Biology (Cont'd)	<p>produce larger human-chromosome specific DNA fragments for each of the 24 types of human chromosomes. Work began at three centers to develop a basis for establishing the linear order of DNA fragments for selected human chromosomes. Investigations to identify, clone and sequence DNA repair genes resulted in the successful cloning of two separate human genes. (\$17,699)</p>	<p>will be explored with emphasis on developing automated technology which will reduce sequencing costs by orders of magnitude. Increased effort will be devoted to elucidation of DNA repair processes in humans. (\$22,848)</p>	<p>of large DNA fragments for each human chromosome and in conjunction with other agencies set up a repository for the storage, replication and distribution of these fragments. Significantly increase efforts to improve develop and evaluate DNA-sequencing and related technologies needed for molecular characterization of the human genome. (\$28,070)</p>
Cell Biology	<p>Research addressed genetic, cellular and extracellular factors that affect differentiation, and the molecular mechanisms by which radiation and chemicals transform cells to the neoplastic state. Results showed that the majority of canine and human tumors which arise following radiation exposures contain activated protooncogenes, or onocogenes; 75% of a group of human protooncogenes map at the same regions as known cancer-specific chromosomal break points, which are sites of gross chromosome rearrangements of the type seen in malignant cells; and certain genes whose products are involved in the transmission of extracellular signals, e.g., hormones, to nuclear genes are rapidly but only transiently induced to activity. (\$5,553)</p>	<p>Sustain research on the role of specific genes and classes of genes, extracellular signal molecules, and cell membrane receptors that are involved in normal cell differentiation and in the development of malignant cells. (\$4,513)</p>	<p>Continue fundamental research on cell replication, differentiation, and regulation in relation to fundamental aspects of cancer biology. (\$4,644)</p>

III. GENERAL LIFE SCIENCES (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Chemical Physics	<p>The biology beam lines on both the vacuum ultraviolet and x-ray rings at the National Synchrotron Light Source were fully instrumented and became operational. In initial tests, x-ray diffraction patterns of even weakly diffracting structures were obtained in milliseconds. Research was initiated on advanced methodology for DNA sequencing, on computational support for physical mapping of chromosomes, and on development of a computerized data base of human genome DNA sequences. Chemical physics research addressed fundamental energy degradation processes in biomolecules and related model compounds. (\$4,943)</p>	<p>Upgrading of neutron spectrometry facility at the High Flux Beam Reactor will include addition of two new detectors and improvements in data management capabilities for protein crystallography. Research on new physical instrumentation and techniques for high speed, low cost sequencing of human DNA will increase. Development of a human genome information resource and computational techniques for data base analysis will be accelerated. Chemical physics studies will continue to define biomolecular energy transfer processes. (\$6,948)</p>	<p>Development of advanced instrumentation for structural biology research at synchrotron facilities will be maintained with emphasis on high speed, position sensitive x-ray detectors. Increased effort will be placed on human genome data base development and analysis. Research on promising new DNA sequencing technologies will be accelerated. Chemical physics research will emphasize computational studies in quantum biology to strengthen the theoretical basis for describing energy relaxation processes. (\$10,347)</p>
Total General Life Sciences	\$33,286	\$39,751	\$51,061

I. Preface: NUCLEAR MEDICINE

Nuclear Medicine research involves a wide range of projects directed to clinical and other beneficial applications of energy-related technologies. Radiopharmaceuticals research involves development of and/or biomedical studies with new radiopharmaceuticals, largely in studies of brain and heart metabolism, but also in diagnosis and therapy involving other organs. Clinical feasibility research includes in-vivo testing of new radiopharmaceuticals in animals and subsequently in selected patients. Methods are evaluated for the study, diagnosis, and treatment of diseases such as cardiopulmonary disease, mental disorders, cancer, and metabolic disorders. The instrumentation program focuses primarily on advanced detector research, improved resolution of positron emission tomography and other imaging techniques. Particle beam, heavy ion therapy, and boron neutron capture therapy research is conducted to treat inoperable tumors in the brain.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Stable Isotopes Research.....	\$ 1,400	\$ 1,460	\$ 1,446	- 1
Radioisotope Development.....	2,485	2,750	2,796	+ 2
Radiopharmaceuticals.....	8,635	18,578	18,131	- 2
Instrumentation.....	3,930	4,452	4,603	+ 3
Clinical Feasibility.....	5,308	7,900	7,534	- 5
Total, Nuclear Medicine.....	\$ 21,758	\$ 35,140	\$ 34,510	- 2

II. B. Major Laboratory and Facility Funding

Argonne National Laboratory....	\$ 550	\$ 380	\$ 380	--
Brookhaven National Laboratory.	5,330	5,901	6,020	+ 2
California, Univ. of at Davis..	200	200	200	--
Lawrence Berkeley Laboratory...	2,140	2,265	2,555	+ 13
Los Alamos National Laboratory.	2,555	1,985	1,850	- 7
Oak Ridge Associated Univ.....	790	690	859	+ 24
Oak Ridge National Laboratory..	1,015	1,425	1,520	+ 7
Pacific Northwest Laboratory...	228	0	13	--
Total.....	\$ 12,808	\$ 12,846	\$ 13,397	+ 4

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
NUCLEAR MEDICINE			
Stable Isotopes Research	Chemical exchange and liquid thermal diffusion continued for isotope enrichment of calcium, sulfur, and zinc. (\$1,400)	Continue FY 1987 program level of activity. (\$1,460)	Continue FY 1988 program level of activity. (\$1,446)
Radioisotope Development	Use of new BLIP II in development of a variety of radionuclides needed for new and improved diagnostic and therapeutic agents to improve the quality of health care.	Continue FY 1987 program of activity with emphasis on development of radionuclides suitable for therapy.	Continue FY 1988 program level of activity. Initiate feasibility study for single photon emission computed tomography.
	Use of LAMPF 800 MeV protons to develop techniques to produce by spallation a growing number of unique radioisotopes such as aluminium-26, Ti-44, and Si-32. Continue preparation of research isotopes such as Cu-67, Ru-97, and Pd-109. Investigate the feasibility of reactor production of number of radioisotopes such as Sb-125, Eu-155, Mn-54, and Sr-89 free of Sr-90. (\$2,485)	Continue FY 1987 program level of activity. (\$2,750)	Continue FY 1988 program level of activity. (\$2,796)

III. NUCLEAR MEDICINE (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Radiopharmaceuticals	<p>Development of the labeled monoclonal antibody methods for treating surgically inaccessible cancers, in particular, labeling of antibodies with appropriate radionuclides while maintaining the biological activity of the antibody. Examples are copper-67 labeled Lym-1 antibody for initial feasibility studies in patients. Other radiolabeled agents are developed for diagnostic imaging. Continue the study of neurotransmitter receptors by positron- emitting tracers for prolactinoma, breast tumors, and prostatic tumors. A new myocardial imaging agent, copper-64 citrate is being developed for use in diagnostic nuclear medicine.</p>	<p>Continue FY 1987 program level of activity in the development of new radiopharmaceuticals labeled with short-lived/medium- lived radionuclides. Research includes the development of the in-vivo generator system for radioimmunotherapy.</p>	<p>Continue development of new radiopharmaceuticals labeled with positron and single photon radionuclides to study details of biochemical processes on a quantitative and non-invasive basis.</p>
	<p>Examine and evaluate plans to expand current program on neutron capture therapy. Joint BNL/Ohio State/SUNY program leading to clinical trials by 1990. (\$8,635)</p>	<p>Studies will be carried out on the pharmacokinetics of boron compounds in normal and tumor bearing rats. Studies of toxic effects and survival of irradiated glioma cells with and without boron, and studies of tolerance of normal brain to neutron radiation will be conducted. Expand boron neutron capture therapy program based upon NCI review and evaluations of the INE1 proposal. (\$18,578).</p>	<p>Continue syntheses of new boron compounds and develop rapid methods for measuring boron concentrations in blood and tissues. Continue BNCT program based on NCI findings. (\$18,131)</p>

III. NUCLEAR MEDICINE (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Instrumentation	<p>Construction of the Donner 600-crystal positron emission tomography system was completed and initial evaluations made. The system represents a significant advance in spatial resolution and count rate capability. It will be used in studies of heart and brain blood perfusion and metabolism.</p> <p>Development of a miniature, portable gamma camera was initiated. The camera, in conjunction with appropriate radioisotope flow tracers, will be able to provide real time images of blood flow in the operating room or at bedside and should be of great value in cardiac bypass surgery and evaluating organ transplants. (\$3,930)</p>	<p>Completion of a new, hexagonal ring PET system is planned. This instrument has advantages in simplicity and relatively low cost which make it attractive for clinical applications in hospitals as well as basic biomedical research.</p> <p>Performance should be adequate for many medical purposes.</p> <p>Research to develop technology to noninvasively image human brain function will be pursued using a technique called magnetoencephalography. In this technique, the weak magnetic fields produced by neuronal activity are detected and used to produce a three-dimensional image of the brain activity underway. Significant clinical applications are anticipated to detect and locate brain lesions and to characterize functional disorders as well. (\$4,452)</p>	<p>Research on positron emission tomography, magnetoencephalography and other medical imaging instrumentation will continue. The feasibility of magnetic resonance imaging of stable isotopes in the body will be explored. Development of a new portable device for rapid, bedside evaluation of pulmonary edema will be completed. By measuring the scattering of gamma rays in lung tissue with a specially developed high resolution radiation detector, water buildup in the lung can be estimated without interference by the chest wall which has been a serious problem in earlier instruments. (\$4,603)</p>

III. NUCLEAR MEDICINE (Cont'd)

Program Activity

Clinical Feasibility

FY 1987

Perform exercise vs rest studies of myocardial perfusion using sequential injections of rubidium-82 and the Donner 280-crystal positron emission tomograph on patients with coronary artery disease and subjects without disease symptoms.

Initiate a clinical investigative protocol utilizing copper-64 to evaluate Hodgkins disease.

Development of radiochemistry to optimize tumor uptake and increase non-target tissue clearance of the radiolabeled antibody.

Pursue application of heavy ion therapy to human patients. In addition, efforts are being made to develop better beam shapes both pencil and fan beams to improve intensity and also monochromaticity in beam energy.

FY 1988

Rubidium-82 will be studied as a possible blood brain barrier permeability marker for evaluation of the radiation effects from heavy ion radiotherapy.

Approximately 15 patients will be studied for the response of normal tissue at periods of one month and six month post treatment. The usefulness of copper-64 in cardiovascular disease and soft tissue tumors as well as hepatic disease will be investigated.

Verification of dosimetry predictions and therapy feasibility in patients using selected iodine-131 and copper-67 radio-immunopharmaceuticals will be studied.

Research into the therapeutic and diagnostic applications of heavy ion beams will be expanded and the possibility of applying radioactive beam techniques to cerebral blood flow measurement will be explored.

FY 1989

Continue FY 1988 program level of activity. (\$7,534)

III. NUCLEAR MEDICINE (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Clinical Feasibility (Cont'd)	Progress is being made in exploiting K-edge subtraction angiography with synchrotron x-rays, as a safer and less expensive alternative to conventional coronary angiography. (\$5,308)	Continue clinical trials of synchrotron x-ray angiography. (\$7,900)	
Total Nuclear Medicine	\$21,758	\$35,140	\$34,510

I. Preface: CARBON DIOXIDE RESEARCH

The goal of the Carbon Dioxide Research program is to develop a sound, quantitative atmospheric carbon dioxide knowledge base to aid in energy policy decision making. This goal involves the following objectives: improve knowledge of the global carbon cycle; improve estimates of future atmospheric carbon dioxide; project global and regional climatic response to increasing atmospheric CO₂; improve understanding of the direct carbon dioxide effects on productivity of natural and agricultural systems; develop and verify methods for the first detection of global climate change due to increasing atmospheric CO₂; develop the means to understand and quantify the consequences of the direct and indirect effects of CO₂ and climate change on defined resources on a regional basis; define possible options for mitigating long-term consequences of a higher CO₂ atmosphere. Increased emphasis will be placed on the oceans and clouds program due to great uncertainty of their effects on global climate change.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Sources and Sinks.....	\$ 3,192	\$ 3,300	\$ 3,400	+ 3
Climatic Effects.....	4,752	4,900	7,000	+ 43
Vegetative Effects.....	3,071	3,500	3,900	+ 11
Resource Analysis.....	479	900	1,700	+ 89
Information Requirements.....	1,080	1,150	1,200	+ 4
Integration Activities.....	470	226	400	+ 77
Total, Carbon Dioxide Research.....	\$ 13,044	\$ 13,976	\$ 17,600	+ 26

II. B. Major Laboratory and Facility Funding

	FY 1987	FY 1988	FY 1989	% Change
	-----	-----	-----	-----
Brookhaven National Laboratory.	\$ 990	\$ 838	\$ 1,150	+ 37
Lawrence Livermore Nat. Lab....	2,020	1,560	1,600	+ 3
Oak Ridge National Laboratory..	4,622	5,060	5,835	+ 15
Pacific Northwest Laboratory...	375	450	475	+ 6
Oak Ridge Associated Univ.....	48	0	0	--
	-----	-----	-----	-----
Total.....	\$ 8,055	\$ 7,908	\$ 9,060	+ 15

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
-----	-----	-----	-----
Carbon Dioxide	<p>The basic program to reduce CO2 issue uncertainties will continue and a few of the highest priority recommendations from the state-of-the-art reports will be planned. Specifically:</p> <p>Continue to study global sources and sinks of CO2. (\$3,192)</p> <p>A climate model comparison study to ultimately improve the regional prediction capability of these models. Initial emphasis is on understanding clouds as a possible modifier of the greenhouse effect. (\$4,752)</p>	<p>The basic program to reduce CO2 issue uncertainties will continue and a few of the highest priority recommendations from the state-of-the-art reports planned in FY 1987 will be continued. Specifically:</p> <p>Continue to study global CO2 sources and sinks of CO2 and other greenhouse energy related gases. (\$3,300)</p> <p>Continue global climate model intercomparison and improvement initially with collaboration of Chinese and British modeling groups, and start organizing a global climate model diagnosis and applications program. (\$4,900)</p>	<p>The basic program to reduce CO2 issue uncertainties will continue and high priority recommendations from the state-of-the-art reports covering global consideration will be continued, and expanded. Specifically:</p> <p>Continue to study global sources and sinks of CO2 and greenhouse gases emissions. (\$3,400)</p> <p>Implement the global climate diagnosis and applications program with added scientific collaboration with Canada, Germany and the USSR, and conduct research to improve global data and methods to simulate clouds. (\$7,000)</p>

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
Carbon Dioxide (Cont'd)	An experimental study of a rangeland system to determine combined effects of CO2 enrichment, changing climate and the interactions of plants and animals with other physical factors. (\$3,071)	Continue experiments and planning for system level Argo-Ecological systems modeling. (\$3,500)	Continue experiments and begin Argo-Ecological systems modeling. (\$3,900)
	Develop the means to understand and quantify the consequences of the direct and indirect effects of CO2 and climate change on defined resources on a regional basis. (\$479)	Continue the development of regional resource data bases and develop the methods to quantify CO2 reductions through energy conservation and policy research methods. (\$900)	Expand the development of regional resource and analysis techniques covering key global regions, e.g. China and Western Europe as well as regions within the U.S. Conduct analysis to investigate potential CO2 reductions through energy strategic planning. Identify regions in jeopardy and the potential affects on resources such as forests, agriculture. (\$1,700)
	Continue activities of the Carbon Dioxide Information Center. (\$1,080)	Continue activities of the Carbon Dioxide Information Center. (\$1,150)	Continue activities of the Carbon Dioxide Information Center and expanded global networking. (\$1,200)
	Perform integration and evaluation of the overall program. (\$470)	Perform integration and evaluation of the overall program. (\$226)	Perform integration and evaluation of the overall program and expand contact with the international science community. (\$400)
Total Carbon Dioxide Research	\$13,044	\$13,976	\$17,600

I. Preface: PROGRAM DIRECTION

This subprogram provides the Federal staffing resources and associated funding needed to plan, direct, manage, and support a comprehensive multidisciplinary research effort designed to understand the long-term health and environmental effects associated with the development and use of various energy technologies.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Program Direction.....	\$ 3,600	\$ 4,000	\$ 4,000	--
Total, Program Direction.....	\$ 3,600	\$ 4,000	\$ 4,000	--

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
Salaries and Expenses	<p>Provided funds for salaries, benefits, and travel for 53 full-time equivalents (FTE's) in the Office of Health and Environmental Research and related program and management guidance and support for hundreds of active research projects (reviewing and evaluating many more throughout the proposal selection process) and conducted major reviews of the numerous BER-sponsored programs at laboratories and universities. Staff also maintained close liaison with other DOE programs, other Federal agencies, and the scientific, academic and industrial communities</p>	<p>Provides funds for salaries and related costs to continue 55 FTE's. Provides for the normal increased personnel costs such as within-grade and merit increases, impact of the agency contribution to the Federal Employees Retirement System (FERS). Staff activities similar to FY 1987 will continue with increased effort in support of research on radon, structural biology, and the human genome program; for instance, extensive interagency coordination will be required to achieve the planned national effort to map and sequence the human genome. (\$3,900)</p>	<p>Provides funds for salaries, benefits, and travel related to continuation of 55 FTE's. Provides for normal increased salary costs including impact of the FY 1988 pay raise, offset by a reduced benefits rate related to FERS. The staff will continue to maintain program management and oversight of the expanded efforts for research on the human genome and site-related problems of waste disposal. This staff will also continue to assess the potential consequences of proposed energy options and to acquire and</p>

III. PROGRAM DIRECTION (Cont'd)

Program Activity	FY 1987	FY 1988	FY 1989
Salaries and Expenses (Cont'd)	and provided the program and management support services required to carry out the program. This staff has become increasingly involved in international affairs. A recent Memorandum of Understanding with the Commission of European Communities promotes research collaboration and program coordination between the respective radiation biology programs. (\$3,292)		analyze data on human genes, which will lead to major health and economic benefits. Additional effort is required to address escalating environmental issues concerning waste and to manage research to provide a continuing resource of fundamental information critical to safe and cost-effective management of DOE waste both now and in the future. (\$3,900)
Other	Provided for a variety of program support such as printing and editing, supplies, services, materials, and contractual services. (\$308)	Continues a variety of support services similar to those required in FY 1987. Also includes time-sharing on various information systems and communications networks such as electronic mail. (\$100)	Continues the variety of program support required in FY 1988. (\$100)
Total Program Direction	\$ 3,600	\$ 4,000	\$ 4,000

I. Preface: FACILITY OPERATIONS

Facility operations provide for the necessary capital equipment and general plant project needs to support the BER program and the Pacific Northwest Laboratory landlord responsibilities. An ability to address health and environmental issues requires a continuing commitment to maintaining advanced instrumentation and facilities.

II. A. Summary Table

Program Activity	FY 1987	FY 1988	FY 1989	% Change
Capital Equipment.....	\$ 8,500	\$ 8,500	\$ 9,000	+ 6
Construction.....	6,000	56,200	3,500	- 94
Total, Facility Operations.....	\$ 14,500	\$ 64,700	\$ 12,500	- 81

II. B. Major Laboratory and Facility Funding

Ames Laboratory.....	\$ 40	\$ 30	\$ 40	+ 33
Argonne National Laboratory....	620	500	530	+ 6
Brookhaven National Laboratory.	1,037	700	760	+ 9
E. I. DuPont DeNemours.....	25	20	20	--
Lawrence Berkeley Laboratory...	485	450	400	- 11
Lawrence Livermore Nat. Lab....	865	850	920	+ 8
Los Alamos National Lab.....	1,115	1,000	1,070	+ 7
Oak Ridge National Laboratory..	1,475	1,000	890	- 11
Pacific Northwest Laboratory...	2,710	2,620	2,610	--
California, Univ. of at Davis..	60	30	0	- 100
California, Univ. of at San Francisco.....	140	110	150	+ 36
Environmental Measurements Lab.	335	333	345	+ 4
Georgia, University of.....	45	35	30	- 14
Inhalation Toxicology Research Institute.....	1,326	1,150	1,400	+ 22
Oak Ridge Associated Univ.....	700	550	500	- 9
Utah, University of.....	85	0	0	--
Total.....	\$ 11,063	\$ 9,378	\$ 9,665	+ 3

III. Activity Descriptions

Program Activity	FY 1987	FY 1988	FY 1989
Capital Equipment	Capital equipment funds are provided to support the research program by maintaining state-of-the-art instrumentation. Funds are provided to the national laboratories (\$6,572), which includes \$1,000 for the landlord functions at Pacific Northwest Laboratory, BER dedicated laboratories (\$1,500), and other miscellaneous institutions (\$428).	The FY 1988 capital equipment budget will allow the program to continue providing essential instrumentation at the FY 1987 level. (\$8,500)	Capital equipment budget will be maintained at FY 1988 level with a minor adjustment for cost of living. (\$9,000)
Total Capital Equipment	\$ 8,500	\$ 8,500	\$ 9,000
Construction	General plant project funds are provided for the landlord functions at Pacific Northwest Laboratory (\$1,000), programmatic needs at the national laboratories (\$800), and BER dedicated laboratories (\$1,200). Funding was also provided for preliminary engineering efforts on the Institute for Nuclear Medicine in Newark, New Jersey (\$3,000).	The FY 1988 general plant project budget allows for continued support of GPP needs comparable to FY 1987. Funds were provided to support university construction projects. (\$56,200)	The general plant project budget will be maintained at the FY 1988 level. (\$3,500)
Total Construction	\$ 6,000	\$ 56,200	\$ 3,500
Total Facility Operations	\$ 14,500	\$ 64,700	\$ 12,500
Total, Biological and Environmental Research	\$191,118	\$270,200	\$249,000

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL BUDGET REQUEST
 ENERGY SUPPLY RESEARCH AND DEVELOPMENT
 (dollars in thousands)

KEY ACTIVITY SUMMARY

CONSTRUCTION PROJECTS

Biological and Environmental Research

IV. A. Construction Project Summary

<u>Project No.</u>	<u>Project Title</u>	<u>Total Prior Year Obligations</u>	<u>FY 1988 Appropriated</u>	<u>FY 1989 Request</u>	<u>Remaining Balance</u>	<u>TEC</u>	
89-R-120	General Plant Projects	\$ XXX	\$ 3,000	\$ 3,500	\$ 0	\$ XXX	
<hr/>		<hr/>		<hr/>		<hr/>	
Total, Biological and Environmental Construction		\$ XXX	\$ 3,000	\$ 3,500	\$ 0	\$ XXX	

DEPARTMENT OF ENERGY
 FY 1989 CONGRESSIONAL REQUEST
 ENERGY SUPPLY RESEARCH AND DEVELOPMENT
 (dollars in thousands)

KEY ACTIVITY CONSTRUCTION PROJECT SUMMARY

Biological and Environmental Research

IV. B. Plant Funded Construction Project

1. Project title and location: 89-R-120 General Plant Projects

Project TEC: \$ 3,500
 Start Date: FY 1989
 Completion Date: FY 1991

2. Financial schedule:

<u>Fiscal Year</u>	<u>Obligations</u>	<u>Costs</u>			
		<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>	<u>After FY 1989</u>
Prior Year Projects	XXXXXXXX	\$ 1,967	\$ 1,250	\$ 925	\$ 1,126
FY 1987 Projects	\$ 3,000	28	1,400	500	225
FY 1988 Projects	3,000	0	750	1,200	1,050
FY 1989 Projects	3,500	0	0	875	2,625

3. Narrative:

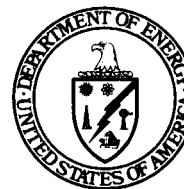
This estimate is for minor new construction and other capital alterations to land, buildings, and utilities systems. The estimate also includes the cost of installed equipment which is an integral part of the general plant subprojects.

General plant projects are necessary to maintain facilities in an environmentally safe and health hazard free condition. They are also required to keep facilities in adequate repair, including roads, parking lots, pavements, etc. The BER program supports such needs as a landlord responsibility for the Pacific Northwest Laboratory and for other laboratories and universities.

Congressional Budget Request

Non-Defense Activities
Construction Project Data Sheets

FY 1989



U.S. Department of Energy

Assistant Secretary,
Management and Administration
Office of the Controller
Washington, D.C. 20585

February 1988

DEPARTMENT OF ENERGY
FISCAL YEAR 1989 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC RESEARCH USER FACILITIES
GENERAL SCIENCE AND RESEARCH
URANIUM ENRICHMENT
NAVAL PETROLEUM AND OIL SHALE RESERVES
FOSSIL ENERGY RESEARCH AND DEVELOPMENT

Energy Supply Research and Development	5
Basic Research User Facilities	357
General Science and Research	437
Uranium Enrichment	455
Naval Petroleum and Oil Shale Reserves	481
Fossil Energy Research and Development	541

NON-DEFENSE CONSTRUCTION PROJECT DATA SHEETS

ENERGY SUPPLY RESEARCH AND DEVELOPMENT

Department of Energy
FY 1989 CONGRESSION BUDGET REQUEST

CONSTRUCTION PROJECT DATA SHEETS
Energy Supply Research and Development - Plant and Capital Equipment
Environmental R & D

(Tabular dollars in thousands. Narrative material in whole dollars.)

- | | |
|--|--|
| 1. Title and location of project: General plant projects | 2. Project No.: 89-R-120 |
| 3. Date A-E work initiated: 1st Qtr. FY 1989 | 5. Previous cost estimate: None
Date: |
| 3a. Date physical construction starts: 2nd Qtr. FY 1989 | 6. Current cost estimate: \$3,500
Date: 12/87 |
| 4. Date construction ends: 2nd Qtr. FY 1991 | |

7. <u>Financial Schedule:</u>	<u>Fiscal Year</u>	<u>Obligations</u>	<u>Costs</u>			
			<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>	<u>After FY 1989</u>
	Prior Year Projects	XXXXXXXX	\$ 1,967	\$ 1,250	\$ 925	\$ 1,126
	FY 1987 Projects	\$ 3,000	28	1,400	500	225
	FY 1988 Projects	3,000	0	750	1,200	1,050
	FY 1989 Projects	3,500	0	0	875	2,625

8. Brief Physical Description of Project

This estimate is for minor new construction and other capital alterations to land, buildings, and utilities systems. The estimate also includes the cost of installed equipment which is an integral part of the general plant subprojects.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: General plant projects

2. Project No.: 89-R-120

8. Brief Physical Description of Project (continued)

Although it is difficult to detail this type project in advance, all of the subprojects identified below are under consideration. In general, the estimated costs for each of the subprojects are preliminary in nature, with a project limitation of \$1,200,000, and primarily indicative of the size of the project. The continuing review of our requirements will result in some of the projects being changed in scope; it will also result in other projects being added to the list with the necessary postponements of some now listed, all depending on conditions or situations not apparent at this time. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property. These general plant projects will provide facilities for conducting critical research programs, contribute to greater efficiency, eliminate health and safety hazards, and will reduce maintenance and operational costs.

The estimate is based on requirements by office as follows:

<u>Summary by Office</u>	
Albuquerque Operations Office.....	\$ 1,500
Oak Ridge Operations Office.....	300
Richland Operations Office.....	1,000
San Francisco Operations Office.....	500
Washington Headquarters.....	200
Total.....	<u>\$ 3,500</u>

9. Purpose, Justification of Need for, and Scope of Project

The following is a tentative tabulation of the major projects to be performed at the various laboratories under the operations office listed.

Albuquerque Operations Office

Inhalation Toxicology Research Institute..... \$ 1,000
Health protection support laboratory, PCB transformers replacement, controlled material storage facility, and other emergency repairs.

Los Alamos National Laboratory..... 500
Exhaust modifications, electrical power upgrade, and other emergency repairs.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: General plant projects

2. Project No.: 89-R-120

9. Purpose, Justification of Need for, and Scope of Project (continued)

Oak Ridge Operations Office

Oak Ridge Associated Universities..... 300
Renovate HVAC systems, fire control system, air handler replacement, and other emergency repairs.

Richland Operations Office

Pacific Northwest Laboratory..... 1,000
Miscellaneous capital work orders, e.g., laboratory additions, improvements, and modifications.

San Francisco Operations Office

Lawrence Livermore National Laboratory..... 500
Modular laboratory building, renovate HVAC, addition to machine shop, and other emergency repairs.

Washington Headquarters.....

200
This estimate covers necessary unanticipated emergency repairs.

10. Details of Cost Estimate

Based on preliminary conceptual design.

11. Method of Performance

Design will be by negotiated architect-engineer contracts. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bids.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.