

DEPARTMENT OF ENERGY
FY 1998 CONGRESSIONAL BUDGET REQUEST
OFFICE OF ENERGY RESEARCH
ENERGY SUPPLY, RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands, narrative in whole dollars)

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

PROGRAM MISSION

The Biological and Environmental Research (BER) program provides fundamental science to underpin the five business thrusts of the Department's strategic plan. Through its support of peer-reviewed research at national laboratories, universities, and private institutions, the program develops the knowledge needed to identify, understand, and anticipate the long-term health and environmental consequences of energy production, development, and use. The research is also designed to provide science in support of the Energy Policy Act of 1992.

The GOAL of the BER program is:

To develop the information, scientific "know-how," and technology for identification, characterization, prediction, and mitigation of adverse health and environmental consequences of energy production, development, and use.

The OBJECTIVES related to these goals are:

1. To CONTRIBUTE TO A HEALTHY CITIZENRY - Map the fine structure of the human genome by the year 2005 providing the basis for development of individual risk assessments; conduct fundamental research necessary for the development of advanced medical technologies and radiopharmaceuticals; and use the unique National Laboratory facilities to determine biological structure and function at the molecular and cellular level in support of this nation's biomedical sciences, pharmaceutical interests, and environmental activities.
2. To CONTRIBUTE TO CLEANUP OF THE ENVIRONMENT - Conduct fundamental research necessary for the development of advanced remediation tools and risk assessment methodologies for containing wastes and cleaning up DOE's contaminated sites, particularly in support of the mission of DOE's Environmental Management (EM) office.
3. To UNDERSTAND GLOBAL ENVIRONMENTAL CHANGE - Acquire the data and develop the understanding necessary to predict if and how energy production and use can affect the global and regional environment.

PROGRAM MISSION - BIOLOGICAL AND ENVIRONMENTAL RESEARCH - (Cont'd)

SCIENTIFIC FACILITIES UTILIZATION:

The Biological and Environmental Research request includes \$39,818,000 to maintain support of the Department's scientific user facilities. Facilities used for structural biology research, such as beam lines at the synchrotron light sources and research reactors were included in the initiative for the first time in FY 1997. In FY 1998, the request includes operation of the new Environmental Molecular Sciences Laboratory where the research facilities will support environmental remediation. This funding will provide for the operation of the facilities, assuring access for scientists in universities, federal laboratories, and U.S. companies. It will also leverage both Federally and privately sponsored research consistent with the Administration's strategy for enhancing the U.S. National science investment.

PERFORMANCE MEASURES:

The quality and appropriateness of the Biological and Environmental Research (BER) program and individual research projects are judged by rigorous peer reviews conducted by internationally recognized scientific experts using criteria such as scientific merit, appropriateness of the proposed approach and qualifications of the principal investigator. Highest quality research is maintained by taking appropriate and, if needed, corrective management actions based on results of the reviews. A measure of the quality of the research is the sustained achievement in advancing knowledge as indicated by the publication of research results in refereed scientific journals, by invited participation at national and international conferences and workshops, and by awards received by DOE-supported BER researchers. Progress in the field is also routinely compared to the scientific priorities recommended by the Health and Environmental Research Advisory Committee (HERAC) and the National Science and Technology Council's (NSTC) committee on Environmental and Natural Resources and Fundamental Science.

An overarching and unique performance measure of the BER program is the diversity of program reviews conducted. This is particularly the case for BER program elements that are components of international research endeavors, e.g., the Human Genome Program and the Global Change Research Program. In addition to panel reviews that evaluate and select individual projects and programmatic reviews by the chartered BER advisory committee, these program elements are evaluated by interagency (and international) review bodies and by Boards and Committees of the National Academy of Sciences.

PROGRAM MISSION - BIOLOGICAL AND ENVIRONMENTAL RESEARCH - (Cont'd)

The BER program goes one step further in soliciting program reviews. Blue ribbon panels, not necessarily in the mainstream of the program's sciences, are charged with evaluating the quality of individual programs and with exploring ways of entraining new ideas and research performers from different scientific fields. This strategy is based on the conviction that the most important scientific advances of the new century will occur at the interfaces between scientific disciplines such as biology and information science. Groups like JASON and The Washington Advisory Group (TWAG), involving physicists, mathematicians, engineers, etc., are among the panels that have studied BER program elements such as the Atmospheric Radiation Measurement (ARM) program, climate change prediction, the Environmental Molecular Sciences Laboratory (EMSL), and the Human Genome Program.

Facility operations are also monitored by peer reviews and user feedback. These facilities are provided in a manner that meets user requirements (as indicated by achieving performance specifications while protecting the safety of the workers and the environment); operates facilities reliably and according to planned schedules; and maintains and improves facilities at reasonable costs.

Examples of BER program specific measures are:

1. Excellence in basic research: Program quality will be maintained at the highest level through merit reviews of research applications and facilities, and advice from the program advisory committee, and JASON; the program goal is that 90 percent of ongoing research will be rated as "very good" and "excellent" following merit review.
2. Access to Human Genome research results: Data on twenty five million subunits of finished human DNA sequence will be submitted to publicly accessible databases; increasing numbers of satisfied or very satisfied researchers will access the DNA sequence data.
3. Progress in Boron Neutron Capture Therapy (BNCT) Research: The effectiveness of BNCT will be determined through a second Food and Drug Administration sanctioned Phase I/II clinical trial which began in June 1996 with fifteen patients. This trial, which is expected to be completed in early FY 1998, will define optimum drug dosage and neutron exposure.
4. Environmental remediation developments: The development of advanced remediation tools (e.g., bioremediation) and risk assessment methodologies to contain hazardous waste and clean up DOE contaminated sites will be derived from fundamental research in environmental sciences, biology, molecular sciences, and mathematical modeling.

PROGRAM MISSION - BIOLOGICAL AND ENVIRONMENTAL RESEARCH - (Cont'd)

5. Atmospheric Radiation Measurement (ARM) accomplishments: Two intensive operations periods will be conducted at the ARM Southern Great Plains Site; two additional atmospheric radiation and cloud stations will become operational; and a next-generation climate model will be developed.
6. Environmental Molecular Sciences Laboratory (EMSL) collaboration products: Increase the number of EMSL products from collaborations (e.g., publications, patents, databases, software releases, technical reports, instruments developed, etc.).

SIGNIFICANT ACCOMPLISHMENTS AND PROGRAM SHIFTS:

- o Critical information has been acquired regarding the molecular nature of the human genome and genomes of other organisms, and explorations are continuing on the basic chemical structures of important biological molecules as they relate to the functions of living cells. These continued advances are central to understanding health effects and human disease-susceptibility at both the population and individual levels and for applications of biotechnology to the Department's missions. Increased emphasis will be placed on large-scale sequencing of select chromosomes.
- o Significant progress has been made to understand the complex relationships between genes, the proteins they encode, and the biological functions of these proteins in the context of the whole organism.
- o The Human Genome program will place increased emphasis on high-throughput sequencing of DNA to meet the joint DOE/NIH program goal of sequencing the entire Human Genome by FY 2005.
- o New strategies for cleanup, including the use of biotechnology (e.g., microbes that break down contaminants), are being developed for stubborn remediation problems.
- o Advanced technologies are being developed from resources and tools produced in the human genome program, to determine and mitigate the potential health effects from energy activities and cleanup operations. Emphasis is placed on the risks to human health from exposures to low levels of radiation and chemicals, both at home (e.g., radon) and at the DOE workplace (e.g., waste site cleanup).
- o Significant improvements are being made in the predictive tools needed to quantify human-induced and natural global environmental changes, including those from energy production and use. Emphasis remains on the role of clouds in climate and on developing improved climate models using the Nation's most advanced computers.

PROGRAM MISSION - BIOLOGICAL AND ENVIRONMENTAL RESEARCH - (Cont'd)

- o Ocean sciences field research will be completed, delivering new information on the role of the coastal and open ocean in the global carbon cycle.
- o New nuclear medicine technologies and new radiopharmaceuticals incorporating radioisotopes commonly used for nuclear medicine into novel chemical structure for improved medical diagnosis and therapy are being developed, contributing to improved health care delivery while reducing costs by achieving early diagnosis and treatment. Increased emphasis will be placed on improved methodologies for imaging anatomical structures and physiological functions. The long-standing subprogram of research into new radioisotopes for nuclear medicine has become mature and of lower program priority, and is being phased out.
- o The program has developed new measurement technologies (e.g., chemical and biological sensors) in the Medical Applications and Measurement Science subprogram to enhance research carried out in a broad range of BER projects. Examples include resonance ionization spectroscopy for environmental dating and flow cytometry for chromosome and cell separations.

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
PROGRAM FUNDING PROFILE**
(Dollars in thousands)

<u>Subprogram</u>	FY 1996 Enacted <u>Appropriation</u>	FY 1997 Original <u>Appropriation</u>	FY 1997 Adjustments	FY 1997 Current <u>Appropriation</u>	FY 1998 Budget <u>Request</u>
Life Sciences.....	\$145,195	\$148,721	\$0	\$148,721	\$157,037
Environmental Processes.....	112,752	112,333	0	112,333	110,126
Environmental Remediation.....	24,782	34,615	0	34,615	66,435
Medical Applications and Measurement Science.....	58,859	57,293	0	57,293	43,112
Program Direction.....	6,748	0	0	0	0
Subtotal.....	<u>348,336</u>	<u>352,962</u>	<u>0</u>	<u>352,962</u>	<u>376,710</u>
Construction.....	<u>62,620</u>	<u>36,113</u>	<u>0</u>	<u>36,113</u>	<u>0</u>
Subtotal, Biological and Environmental Research.....	410,956	389,075	0	389,075	376,710
Adjustment.....	<u>-11,381</u> a/	<u>-6,702</u> a/	<u>0</u>	<u>-6,702</u> a/	<u>0</u>
TOTAL, BER.....	\$399,575 b/	\$382,373	\$0	\$382,373	\$376,710

a/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program.

The total general reduction is applied at the appropriation level.

b/ Excludes \$6,072,000 which was transferred to the SBIR program and \$459,000 which was transferred to the STTR program.

Public Law Authorization:

Pub. Law 94-91, DOE Organization Act

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

(Dollars in thousands)

PROGRAM FUNDING BY SITE

<u>Field Offices/Sites</u>	<u>FY 1996 Enacted Appropriation</u>	<u>FY 1997 Original Appropriation</u>	<u>FY 1997 Adjustments</u>	<u>FY 1997 Current Appropriation</u>	<u>FY 1998 Budget Request</u>
Albuquerque Operations Office					
Los Alamos National Laboratory	\$20,373	\$15,011	\$0	\$15,011	\$21,365
Sandia National Laboratory	1,924	1,850	0	1,850	1,750
Chicago Operations Office					
Ames Laboratory	676	569	0	569	596
Argonne National Laboratory (East)	17,074	9,789	0	9,789	10,029
Brookhaven National Laboratory	27,490	23,773	0	23,773	21,249
Environmental Measurements Laboratory	4,470	0	0	0	0
Fermi National Accelerator Laboratory	1,575	2,200	0	2,200	0
Idaho Operations Office					
Idaho National Engineering Laboratory	2,646	2,280	0	2,280	2,091
Oakland Operations Office					
Lawrence Berkeley National Laboratory	37,019	19,238	0	19,238	24,167
Lawrence Livermore National Laboratory	20,905	14,712	0	14,712	21,793
Stanford Linear Accelerator Facility (SSRL)	2,515	2,350	0	2,350	2,350
Oak Ridge Operations Office					
Oak Ridge Institute for Science & Education	4,424	2,682	0	2,682	1,862
Oak Ridge National Laboratory	22,758	19,549	0	19,549	19,123
Richland Operations Office					
Pacific Northwest National Laboratory	96,986	83,957	0	83,957	67,121
All Other Sites a/	150,121	191,115	0	191,115	183,214
Subtotal	<u>410,956</u>	<u>389,075</u>	<u>0</u>	<u>389,075</u>	<u>376,710</u>
Adjustment	-11,381 b/	-6,702 b/	0	-6,702 b/	0
TOTAL	<u><u>\$399,575</u></u> c/	<u><u>\$382,373</u></u>	<u><u>\$0</u></u>	<u><u>\$382,373</u></u>	<u><u>\$376,710</u></u>

a/ Funding provided to universities, industry, other Federal agencies and other miscellaneous contractors.

b/ Share of Energy Supply, Research and Development general reduction for use of prior year balances assigned to this program.

The total reduction is applied at the appropriation level.

c/ Excludes \$6,072,000 which was transferred to the SBIR program and \$459,000 which was transferred to the STTR program.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

LIFE SCIENCES

I. Mission Supporting Goals and Objectives:

Research is focused on utilizing unique DOE resources and facilities to develop fundamental biological information and advanced technologies for understanding and mitigating the potential health effects of energy development, energy use, and waste cleanup. Research is conducted in five areas: structural biology, cellular biology, molecular biology, human genome, and health effects. The research:

- Integrates information and technologies from genome, structural biology, and molecular biology research with human health research to understand the complex relationships between genes, the proteins they encode, and the biological functions of these proteins in the context of the whole organism.
- Develops new biotechnologies, including those derived from microbial genome research, for bioremediation applications, and for the mitigation of potential health effects resulting from energy development, energy use, and waste cleanup.
- Supports DOE research at national user facilities for scientists to determine the molecular structure of enzymes, antibodies, and other important biological molecules. Computational biology research combines computer science, structural biology, and genome research to predict the functions of biological molecules.
- Develops and applies new technologies and resources to map and determine the sequence of the subunits of DNA found in a typical human cell, for analyzing and interpreting DNA sequence data, and for studying the ethical, legal, and social implications (ELSI) of information and data resulting from the genome program, especially issues of privacy, intellectual property, and education. Program emphasis is on dramatically increasing the rate at which human DNA is sequenced and entered into public databases.
- Develops new molecular-based tools for health surveillance, biological dosimetry, and individual susceptibility determination to understand and characterize the risks to human health from exposures to low levels of radiation and chemicals both at home and at work. An emphasis is placed on research that utilizes the unique resources and tools developed in the Department's human genome, structural biology, and cellular and molecular biology programs.

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
LIFE SCIENCES**

II. Funding Schedule:

<u>Activity</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Structural Biology	\$28,016	\$27,661	\$28,178	\$ +517	+1.9%
Molecular and Cellular Biology ...	20,442	19,709	20,129	+420	+2.1%
Human Genome	73,912	77,875	85,081	+7,206	+9.3%
Health Effects	22,825	19,979	20,026	+47	+0.3%
SBIR/STTR	<u>0</u>	<u>3,497</u>	<u>3,623</u>	<u>+126</u>	<u>+3.6%</u>
Total, Life Sciences	<u>\$145,195</u>	<u>\$148,721</u>	<u>\$157,037</u>	<u>\$+ 8,316</u>	<u>+5.6%</u>

III. Performance Summary - Accomplishments:

	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Life Sciences</u>			
-Structural biology supports research at national user facilities to determine the molecular structure of important biological molecules to assist in rational drug design, improved biomaterials, and efficient removal of environmental contaminants. The program performs computational biology research aimed at enhancing our understanding of the structure-function relationship of biological macromolecules. Capital equipment funds are provided for the continuation of instrumentation for the neutron beam facility at Los Alamos and to purchase new generation detectors and related instrumentation for existing beamlines at the Department's synchrotrons.	\$28,016	\$27,661	\$28,178
-Molecular biology research develops information and resources to address Departmental biotechnology needs including applications in energy development, energy use, and waste cleanup. Program efforts include determining the sequence and evolutionary relationships of industrially important microbes, determining the relationship between protein structure	13,279	12,278	12,438

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
LIFE SCIENCES**

III. Performance Summary - Accomplishments:	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
and function, and developing approaches to modify the structure of proteins to improve their function. Capital equipment funds provide for structural molecular biology beamline instrumentation.			
-Cellular biology research develops information and resources that exploit and integrate developments in the Department's genome, structural biology, and health effects programs. Program efforts include characterization of factors affecting gene expression, determination of the relationship between the expression of large numbers of genes in cells or tissues, development and use of animal models to understand specific human diseases and to determine the function of known or unknown human genes, and development of methods capable of efficiently determining the function of very large numbers of genes. Capital equipment funds support cellular biology research providing upgrades of flow cytometers, and microscope stage and control equipment.	7,163	7,431	7,691
-Genome research develops and uses resources and technologies for high-throughput human DNA sequencing, mapping and analysis, and studies genome-associated ethical, legal, and social issues. Program emphasis is on high-throughput sequencing, i.e., dramatically increasing the rate at which human DNA is efficiently, accurately, and cost-effectively sequenced and entered into public databases. The Program goal is to sequence the entire human genome which includes 3 billion base sequences, by the year 2005. DOE plans to accomplish 40% of this effort with the balance to be completed by NIH. Other efforts include physical mapping of the human genome, development of a set of analyses that reveal the biological informational content of the sequence data produced, more rapid entry of DNA sequence into public data bases, development of user-	73,912	77,875	85,081

BIOLOGICAL AND ENVIRONMENTAL RESEARCH LIFE SCIENCES

III. Performance Summary - Accomplishments

friendly interoperable databases for DNA map and sequence data, development and distribution of educational programs on genome research and associated societal issues, and support of judges workshops on the use of genetic evidence. Capital equipment funding provides instrumentation for sequencing and computer hardware to support the human genome data bases. A table follows displaying both DOE and NIH genome funding.

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
LIFE SCIENCES**

U.S. HUMAN GENOME PROJECT FUNDING

(Dollars in millions)

	<u>Prior Years</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
DOE Total Funding (includes construction)	\$378.4	\$79.6	\$78.9	\$85.1
NIH Funding	<u>1,044.4</u>	<u>169.3</u>	<u>189.6</u>	<u>205.2</u>
Total U.S. Funding	\$1,422.8	\$248.9	\$268.5	\$290.3

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
LIFE SCIENCES**

III. Performance Summary - Accomplishments

-Health effects research develops and uses information and tools for health surveillance and biodosimetry. Program efforts include completion of lifespan animal carcinogenesis studies to improve estimates of human health risks from radiation exposure, identification and characterization of DNA repair genes, identification of polymorphisms in genes associated with DNA repair that may increase health risk, development of improved techniques to detect small changes in the number of individual chromosomes or genes associated with the development of disease, and integration of rapid DNA screening technologies with information on genes that may increase health risk from radiation or chemicals. Capital equipment funds provide items such as cage washers, centrifuges, themocyclers, laminar flow hoods, phoshoimagers, and computer hardware for confocal microscopes in support of health effects research.

FY 1996 FY 1997 FY 1998

22,825 19,979 20,026

SBIR/STTR

-In FY 1996 \$2,649,000 and \$184,000 were transferred to the SBIR and STTR programs respectively. The FY 1997 estimate is for both SBIR and STTR. The FY 1998 estimate is for SBIR only since Part D, Section 110 of P.L. 104-208, making Omnibus Consolidated Appropriations for FY 1997 reauthorized STTR for FY 1997 only.

0 3,497 3,623

TOTAL Life Sciences

\$145,195 \$148,721 \$157,037

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
LIFE SCIENCES**

EXPLANATION OF FUNDING CHANGES FROM FY 1997 TO FY 1998:

-Increase in Human Genome funding will allow: an increase in the annual rate of finished DNA base sequences of 10 million bases per year (Mb) in FY 1998, to yield a total output of approximately 40Mb in FY 1998; and development of a set of analyses that will reveal the biological content of the sequence data being produced.	\$+7,206,000
-Slight increase in funding for Structural Biology and Molecular and Cellular Biology programs.	+937,000
-Slight increase in funding for the Health Effects program.	+47,000
-SBIR/STTR - Change in SBIR (\$+324,000) due to increase in operating budget and no STTR funding in FY 1998 (\$-198,000).	+126,000
Total Funding Change, Life Sciences	<u>\$+8,316,000</u>

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

ENVIRONMENTAL PROCESSES

I. Mission Supporting Goals and Objectives:

Research is focused on understanding the basic chemical, physical, and biological processes of the Earth's atmosphere, land, and oceans and how these processes may be affected by energy production and use, primarily the emission of carbon dioxide from fossil fuel combustion. A major part of the research is designed to provide the data that will enable an objective assessment of the potential for, and consequences of, global warming. The program is comprehensive with an emphasis on understanding the radiation balance from the surface of the Earth to the top of the atmosphere (including the role of clouds) and on enhancing the quantitative models necessary to predict possible climate change at the global and regional scales. There are four contributing areas to this research program: Climate and Hydrology, Atmospheric Chemistry and Carbon Cycle, Ecological Processes, and Human Interactions. The National Institute for Global and Environmental Change (NIGEC) is included within these four areas. The Environmental Processes subprogram is DOE's contribution to the U.S. Global Change Research Program that was codified by Congress in the Global Change Research Act of 1990.

II. Funding Schedule:

<u>Activity</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Climate and Hydrology	\$64,475	\$63,697	\$62,356	\$-1,341	-2.1%
Atmospheric Chemistry and Carbon Cycle	25,569	26,020	23,993	-2,027	-7.8%
Ecological Processes	13,195	10,991	12,029	+1,038	+9.4%
Human Interactions	9,513	8,951	9,172	+221	+2.5%
SBIR/STTR	<u>0</u>	<u>2,674</u>	<u>2,576</u>	<u>-98</u>	<u>-3.1%</u>
Total, Environmental Processes	<u>\$112,752</u>	<u>\$112,333</u>	<u>\$110,126</u>	<u>\$-2,207</u>	<u>-2.3%</u>

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL PROCESSES**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Climate and Hydrology</u>			
<p>-Climate models on massively-parallel super-computers are used to simulate climate change, predict climate, and evaluate model uncertainties due to changes in atmospheric concentrations of greenhouse gases and modeling activities on decade-to-century timescales. Climate models (General Circulation Models) are being improved based on increasing understanding of the physical phenomena that define cloud and radiation processes, including those based on data acquired through the Atmospheric Radiation Measurement Program. Continued intercomparison of climate models results in the inclusion of new data and the refinement of the models. Activities in these areas include research performed through the National Institute of Global Environmental Change (NIGEC).</p>	\$21,556	\$21,554	\$20,307
<p>-Under the Atmospheric Radiation Measurement (ARM) Program and the ARM Unmanned Aerial Vehicle (UAV) Program, research aimed at solving the role of clouds in climate change continues to provide new data to the scientific community. An effort to explore a potentially critical difference between the results of extensive data analysis and model calculations of short wave absorption prompted a data gathering mission which involved the ARM Southern Great Plains Site, flights by three aircraft, and extensive temporary ground instrumentation to complement existing instrumentation at the site. Data from this effort is still being analyzed. The ARM Program is scheduled to complete the installation of instrumentation at two additional major sites in regions which are climatologically significant to the cloud-radiation aspects of climate change--they are in the Tropical Western Pacific (TWP) and on the North Slope of Alaska (NSA). Capital equipment funding will be</p>	42,919	42,143	42,049

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL PROCESSES**

III. Performance Summary - Accomplishments **FY 1996** **FY 1997** **FY 1998**

used to support the development and instrumentation of the third ARM site on the North Slope of Alaska, to develop and build the second Atmospheric Radiation and Cloud Station (ARCS) for the ARM site in the Tropical Western Pacific, and to maintain instrumentation at the Southern Great Plains (Oklahoma-Kansas) site at the state-of-the-art level needed to achieve the mission of the Atmospheric Radiation Measurement (ARM) program. The first of the ground facilities in the TWP has been installed. The NASA effort will field a facility in 1998, in concert with the National Science Foundation's Solar Heat Budget of the Arctic Ocean (SHEBA).

Atmospheric Chemistry and Carbon Cycle

-Research provides atmospheric chemistry data necessary to understand pollutant transport and effects of tropospheric ozone. Initiate and implement prototypical study of air quality in megacities. Participate in the North American Research Strategy for Tropospheric Ozone (NARSTO) Program. Complete measurements of ocean carbon in the Indian and North Atlantic Oceans as part of the global survey to understand the role of oceans in the uptake of atmospheric carbon dioxide. Complete field experiments at land-ocean interface. Implement research in environmental marine biotechnology that builds upon expertise in marine sciences and modern biological sciences. Provide improved estimates of atmospheric carbon dioxide changes that result from fossil fuel combustion. Continue to model terrestrial carbon processes, and coupled with atmosphere-ocean modeling, estimate rate and timing of atmospheric carbon dioxide exchange. Implement carbon dioxide flux measurement network. Activities in these areas include research performed through the National Institute of Global Environmental Change

25,569 26,020 23,993

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL PROCESSES**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
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(NIGEC). Capital equipment funds support field instruments such as those used to measure carbon dioxide fluxes and ozone precursors.

Ecological Processes

<p>-Continue experiments to quantify forest ecosystem responses to elevated carbon dioxide and climate variation. Improve understanding of the terrestrial biosphere's role in the uptake of carbon dioxide. Increase activities focused on developing an understanding of the interactions and feedback effects between the atmosphere and ecological systems. Quantify responses of forest and arid land ecosystems to alterations in precipitation. Complete regional analysis to identify ecological systems most sensitive to climatic variation and change to provide improved assessments of consequences of climate change. Activities in these areas include research performed through the National Institute of Global Environmental Change (NIGEC). Capital equipment funds are used to purchase field instruments such as those used to measure plant responses to changes in soil moisture and atmospheric composition and to replace worn out laboratory instruments, such as autoclaves, used to sterilize materials for soil microbiology experiments.</p>	13,195	10,991	12,029
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Human Interactions

<p>-Integrated Assessment framework will be developed, tested, and used to identify priority research needs. Risk assessment research develops new ways to identify economically efficient, environmentally sound solutions and technologies. Under the Information Program, massive amounts of data from a wide range of research programs in environmental</p>	9,513	8,951	9,172
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**BIOLOGICAL AND ENVIRONMENTAL RESEARCH PROGRAM
ENVIRONMENTAL PROCESSES**

III. Performance Summary - Accomplishments

FY 1996

FY 1997

FY 1998

processes will be stored, evaluated, and shared with a broad range of investigators in all related fields. The success of the global change graduate and postdoctoral fellowship program will be evaluated with respect to training new scientists with cross-disciplinary skills. A new program that meets the continuing needs of developing research manpower in the disciplines that address uncertainties in environmental processes will be initiated and implemented, as appropriate. There will be continued support for the inclusion of minority institutions in research-oriented programs. Research performed through the National Institute of Global Environmental Change (NIGEC) includes activities in these areas.

SBIR/STTR

0

2,674

2,576

-In FY 1996 \$1,526,000 and \$123,000 were transferred to the SBIR and STTR programs respectively. The FY 1997 estimate is for both SBIR and STTR. The FY 1998 estimate is for SBIR only since Part D, Section 110 of P.L. 104-208, making Omnibus Consolidated Appropriations for FY 1997 reauthorized STTR for FY 1997 only.

TOTAL Environmental Processes

\$112,752

\$112,333

\$110,126

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL PROCESSES**

EXPLANATION OF FUNDING CHANGES FROM FY 1997 TO FY 1998:

Climate and Hydrology

-A decrease of \$2,035,000 in ARM funding reflects the reduction in equipment funding resulting from the completion of equipment installation at the Tropical Western Pacific Site. An increase of \$1,941,000 in UAV research to transition the research from joint Strategic Environmental Research and Development Program (SERDP)/DOE funding allows one UAV flight mission and scientific analysis of data. A decrease of \$1,204,000 reflects reduced support for the Computer Hardware, Advanced Mathematics and Model Physics (CHAMMP) program and other modeling efforts. A decrease of \$43,000 allows the modeling program to continue at the FY 1997 level of effort.

\$-1,341,000

Atmospheric Chemistry and Carbon Cycle

-The \$2,027,000 decrease reflects reduced activities within the Atmospheric Sciences element following the completion of field experiments and measurements and also reflects the transition of ocean research programs from expensive ocean-based experiments to laboratory-based studies in marine biotechnology.

\$-2,027,000

Ecological Processes

-Increase supports new experimental studies of effects of climate and atmospheric changes on ecological systems and processes and continues ongoing long-term effect studies.

\$+1,038,000

Human Interactions

-Continuation of activities at approximately the FY 1997 level.

\$+221,000

SBIR/STTR

-Change due to no STTR funding in FY 1998 (\$-152,000) and an increase in SBIR (\$+54,000) due to increased operating funding.

\$-98,000

Total Funding Change, Environmental Processes

\$-2,207,000

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

ENVIRONMENTAL REMEDIATION

I. Mission Supporting Goals and Objectives:

The research is primarily focused on gaining a better understanding of the fundamental physical, chemical, geological, and biological processes that must be marshaled for the development and advancement of new, effective, and efficient processes for the remediation and restoration of the Nation's nuclear weapons production sites. Priorities of this research include bioremediation, operation of the Environmental Molecular Sciences Laboratory (EMSL), and the fundamental research in support of the Department's cleanup and environmental missions. Bioremediation activities are centered on a new basic research program, the Natural and Accelerated Bioremediation Research (NABIR) program, focused on determining the conditions under which bioremediation will be a reliable, efficient, and cost-effective technique. This subprogram also includes basic research in support of pollution prevention and sustainable technology development. Bioremediation research develops the scientific information needed to develop and apply efficient, cost-effective bioremediation methods for remediating and restoring contaminated environments. Clean-up research is a research effort to develop information on physical, chemical, and biological processes required for developing advanced, cost-effective technologies and strategies to remediate contaminated environments. Facility operations supports the operation of the new EMSL user facility for basic research that will underpin safe and cost-effective environmental remediation methods and technologies.

II. Funding Schedule:

<u>Activity</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Bioremediation Research	\$17,746	\$21,204	\$28,073	\$ +6,869	+32.4%
Clean-Up Research	6,476	7,794	7,758	-36	-0.5%
Facility Operations	560	4,897	29,143	+24,246	+495.1%
SBIR/STTR	0	720	1,461	+741	+102.9%
Total, Environmental Remediation	<u>\$24,782</u>	<u>\$34,615</u>	<u>\$66,435</u>	<u>\$+31,820</u>	<u>+ 91.9%</u>

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL REMEDIATION**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Bioremediation Research</u>			
-Conduct research activities identified in the 10-year plan on bioremediation, the Natural and Accelerated Bioremediation Research (NABIR) program. Identify and establish the first NABIR field research center. Begin the long-term research, including aspects of the microbial genome program, necessary to identify key microbial, biotransformation, and biogeochemical processes to enhance the utility of bioremediation and develop strategies to represent these processes in predictive models.	\$13,133	\$15,192	\$22,093
-General Plant Projects (GPP) funding is for minor new construction, other capital alterations and additions, and for buildings and utility systems. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and in meeting its requirement for safe and reliable facilities operation. This subprogram includes landlord GPP funding for Pacific Northwest National Laboratory (PNNL) and for Oak Ridge Institute for Science and Education (ORISE).	3,488	4,837	4,811
-General Purpose Equipment (GPE) funding for general purpose equipment for PNNL and ORISE.	1,125	1,175	1,169

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL REMEDIATION**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Clean-Up Research</u>			
-Link long-term research on the physical, chemical, and geological studies of contaminant transport with related activities in the Office of Science and Technology within the Office of Environmental Management. Acquire data at the Environmental Molecular Sciences Laboratory and implement results in development of new understandings and technologies necessary to advance environmental remediation. Develop assessment and modeling tools useful for developing pollution prevention technologies.	6,476	7,794	7,758
<u>Facility Operations: Environmental Molecular Science Laboratory (EMSL)</u>			
-EMSL becomes fully operational as a national user facility in FY 1998. Operating funds provide essential maintenance of instruments and associated support facilities at the Laboratory, and technical and ES&H support needed to ensure access to and application of EMSL capabilities by the user community. Includes capital equipment funding to support instrument modifications needed by collaborators and external users of the facility and to maintain the spectroscopic and computer equipment at state-of-the-art.	560	4,897	29,143
<u>SBIR/STTR Funding</u>	0	720	1,461
-In FY 1996 \$744,000 and \$66,000 were transferred to the SBIR and STTR programs respectively. The FY 1997 estimate is for both SBIR and STTR. The FY 1998 estimate is for SBIR only since Part D, Section 110 of P.L. 104-208, making Omnibus Consolidated Appropriations for FY 1997 reauthorized STTR for FY 1997 only.			
TOTAL Environmental Remediation	<u>\$24,782</u>	<u>\$34,615</u>	<u>\$66,435</u>

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL REMEDIATION**

EXPLANATION OF FUNDING CHANGES FROM FY 1996 TO FY 1997:

-Increase of funding in the NABIR program allows the initiation of the first field research center and the development of a strong research program in all seven scientific elements, enabling the integrated thrust of research development.	\$+6,901,000.
-GPP and GPE funding will continue at approximately the FY 1997 level.	-32,000
-Continuation of clean-up research at FY 1997 level.	-36,000
-Increase in funding supports first full year of EMSL operations.	+24,246,000
-SBIR/STTR Change in SBIR funding (\$+784,000) due to increase in operating budget for Environmental Remediation. No funding for STTR in FY 1998 (\$-43,000).	+741,000
Total Funding Change, Environmental Remediation	<u>\$+31,820,000</u>

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

MEDICAL APPLICATIONS AND MEASUREMENT SCIENCE

I. Mission Supporting Goals and Objectives:

The medical applications subprogram supports research to develop beneficial applications of nuclear and other energy-related technologies for medical diagnosis and treatment. The research develops applications of radiotracer agents for medical research using recent advances in instrumentation as well as in computational, molecular, and structural biology. A major emphasis is placed on non-invasive diagnostic tools, including imaging technologies such as positron emission tomography. The research in this activity is conducted in six specific areas: Radioisotope Development, Radiopharmaceuticals, Instrumentation, Clinical Feasibility, Boron Neutron Capture Therapy (BNCT), and Molecular Nuclear Medicine.

The measurement science subprogram focuses on research and development of new measurement technologies to meet the needs of environmental and life sciences research of the Biological and Environmental Research program and other departmental customers. Emphasis is placed on using the advanced technologies developed in the Department's National Laboratories for environmental and biomedical research. Dosimetry research is devoted to providing fundamental understanding of interactions of radiation with matter needed to improve BNCT and other programs in medical applications and the life sciences.

II. Funding Schedule:

<u>Activity</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Medical Applications	\$50,941	\$48,723	\$36,196	\$-12,527	-25.7%
Measurement Science	7,918	7,041	5,858	-1,183	-16.8%
SBIR/STTR	<u>0</u>	<u>1,529</u>	<u>1,058</u>	<u>-471</u>	<u>-30.8%</u>
Total, Medical Applications & Measurement Science	<u>\$58,859</u>	<u>\$57,293</u>	<u>\$43,112</u>	<u>\$-14,181</u>	<u>-24.8%</u>

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
MEDICAL APPLICATIONS AND MEASUREMENT SCIENCE**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Medical Applications</u>			
<p>-Complete Phase I/Phase II human clinical trials of boron neutron capture therapy (BNCT) at Brookhaven National Laboratory, Massachusetts Institute of Technology and Ohio State University and follow up successful trials with additional clinical trials at higher drug and radiation dosages. Initiate collaboration with the National Cancer Institute to compare BNCT with conventional modes of therapy; complete research in dosimetry for BNCT. Capital equipment funds are provided for instrumentation needed to upgrade beamlines used for early clinical trials at BNCT.</p>	\$10,198	\$10,161	\$10,733
<p>-Develop new approaches to radiopharmaceutical design and synthesis using genome sequencing information, combinatorial chemistry and computational modeling concepts. Develop new diagnostic probes for detection of cancer using advanced molecular biology techniques. Initiate research into biochemical control networks to identify targets for improved molecular nuclear medicine diagnosis and therapy approaches.</p>	16,807	17,091	17,806
<p>-The installation of a high field magnetic resonance imaging (MRI) system at the Brookhaven Imaging Center will allow integration of MRI with Positron Emission Tomography to produce multimodal systems for studies of human brain function in normal and diseased states. Develop new applications of imaging and laser technology and determine their feasibility for medical practice. Capital equipment funds are provided in support of research into new imaging techniques in nuclear medicine and for instrumentation needed for development of new detectors for medical isotopes.</p>	5,799	5,747	6,208

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
MEDICAL APPLICATIONS AND MEASUREMENT SCIENCE**

III. Performance Summary - Accomplishments	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<p>-Research into new radioisotopes for nuclear medicine applications has matured and become a lower program priority, and is being phased out, resulting in a reduced budget in FY 1998. The requested funds will allow for completion of existing projects and termination costs as needed. Capital equipment funds supporting radioisotope research are used to purchase instrumentation such as radiation detectors.</p>	3,033	3,039	1,449
<p>-Funding for Oregon Health Sciences University and Biomedical Research Foundation of Northwest Louisiana, as included in Congressional direction for FY 1996. Funding for Indiana School of Medicine and Oregon Health Sciences University, as included in Congressional direction for FY 1997. Funding for these projects is completed in FY 1997.</p>	15,104	12,685	0
<u>Measurement Science</u>			
<p>-Complete research on new biosensors capable of making measurements in single cells; continue development of laser instrumentation for environmental applications. Capital equipment funds are provided for components needed for research into new instrumentation for environmental and life sciences applications.</p>	7,918	5,541	5,858
<p>-Facility modifications and improvements are necessary to ensure continued safe operation and reliability of accelerators, reactors, and other existing BER-related facilities. The FY 1997 funds will be used to upgrade laboratory facilities to current safety standards; to replace obsolete laboratory components such as fume hoods,</p>	----	1,500	----

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
MEDICAL APPLICATIONS AND MEASUREMENT SCIENCE**

III. Performance Summary - Accomplishments

beamline optics, radioisotope hot cells and biological cold rooms; to provide proper waste treatment and storage equipment for materials that pose toxic, radioactive, or biological hazards; and to replace electrical, optical, and mechanical components of such systems where newer models provide for improved facility operation.

SBIR/STTR Funding

-In FY 1996 \$1,153,000 and \$86,000 were transferred to the SBIR and STTR programs respectively. The FY 1997 estimate is for both SBIR and STTR. The FY 1998 estimate is for SBIR only since Part D, Section 110 of P.L. 104-208, making Omnibus Consolidated Appropriations for FY 1997 reauthorized STTR for FY 1997 only.

FY 1996 FY 1997 FY 1998

0 1,529 1,058

TOTAL Medical Applications and Measurement Science

\$58,859 \$57,293 \$43,112

EXPLANATION OF FUNDING CHANGES FROM FY 1997 TO FY 1998:

-The radioisotope development program is being phased out.	\$-1,590,000
-Continuation of activities in BNCT at approximately the FY 1997 level with additional funding for equipment.	+572,000
-Decrease in facilities modifications and improvements. No projects are planned for FY 1998.	-1,500,000
-Completed funding for Congressionally directed projects.	-12,685,000
-Slight increase in funding for research on new biosensors.	+317,000

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
MEDICAL APPLICATIONS AND MEASUREMENT SCIENCE**

-Slight increase in funding for the development of new applications of imaging and laser technology with additional funds for equipment.	+461,000
-Slight increase in funding for molecular nuclear medicine.	+715,000
-Change in SBIR funding (\$-388,000) due to decrease in operating budget for the Medical Applications and Measurement Science program. No STTR funding in FY 1998 (\$-83,000).	-471,000
Total Funding Change, Medical Applications and Measurement Science	<u>\$-14,181,000</u>

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

PROGRAM DIRECTION

I. Mission Supporting Goals/Ongoing Responsibilities:

This subprogram was transferred to the new Energy Research, Energy Supply Research and Development Program Direction decision unit in FY 1997 at the direction of Congress. Program direction provides for the federal staffing resources and related expenses necessary to plan, manage, lead, and coordinate the diverse research activities of the Biological and Environmental Research program conducted at the Department's national laboratories and at academic institutions and private industrial research centers. The staff manage a broad range of multidisciplinary research to underpin the major goals and objectives of the Department's strategic plan as well as national goals for a healthy citizenry and a cleaner environment.

Staff include scientific and technical personnel and program management support in the areas of budget and finance, personnel administration, grants and contracts, information resource management, policy review and coordination, and construction management.

II. Funding Schedule:

<u>Activity</u>	FY 1996 Current <u>Appropriation</u>	FY 1997 Original <u>Appropriation</u>	FY 1997 Adjustments	FY 1997 Current <u>Appropriation</u>	FY 1998 Budget <u>Request</u>
Salaries and Benefits	\$ 5,708	\$ 0	\$ 0	\$ 0	\$ 0
Travel	300	0	0	0	0
Support Services	450	0	0	0	0
Other Related Expenses	<u>290</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	<u>\$ 6,748</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>
Full-time Equivalents	61	0	0	0	

**BIOLOGICAL AND ENVIRONMENTAL RESEARCH
PROGRAM DIRECTION**

III. Performance Summary	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
<u>Salaries and Benefits:</u> Funded staff managing and supporting the Biological and Environmental Research program with reduced staffing levels as a result of streamlining efforts.	\$5,708	\$0	\$0
<u>Travel:</u> Provided on-site contractor and facility oversight and participated in major scientific conferences to maintain state-of-the-art scientific expertise.	\$300	\$0	\$0
<u>Support Services:</u> Provided computer system development, environment, health, and safety, and administrative support for the Biological and Environmental Research program.	\$450	\$0	\$0
<u>Other Related Expenses:</u> Provided hardware and software for information technology improvements and other miscellaneous costs of supporting the program.	\$290	\$0	\$0
Total	<u>\$6,748</u>	<u>\$0</u>	<u>\$0</u>

IV. EXPLANATION OF FUNDING CHANGES FROM FY 1997 TO FY 1998:

This subprogram was transferred to the new Energy Supply Research and Development Program Direction decision unit in FY 1997 at the direction of Congress.

Support Services	FY 1996 (\$000)	FY 1997 (\$000)	FY 1998 (\$000)	FY 1998/ FY 1997 Change (\$000)
Technical Support Service				
Feasibility of Design Considerations				
Economic and Environmental Analysis	150			
Test and Evaluation Studies				
Subtotal	150			
Management Support Services				
Management Studies				
Training and Education				
ADP Support	210			
Administrative Support Services	90			
Subtotal	300			
Total Support Services	450			
Use of Prior Year Balances				

Other Related Expenses	FY 1996 (\$000)	FY 1997 (\$000)	FY 1998 (\$000)	FY 1998/ FY 1997 Change (\$000)
Training				
Working Capital Fund				
Printing and Reproduction				
Rental Space				
Software Procurement/Maintenance Activities/Capital Acquisitions	220			
Other	70			
Total Obligational Authority	\$290			
Use of Prior-Year Balances				
Total Budget Authority	\$290			

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

CONSTRUCTION

I. Mission Supporting Goals and Objectives:

Construction is needed to support the BER program. Cutting-edge basic research requires that state-of-the-art facilities be built or existing facilities modified to meet unique BER requirements.

II. Funding Schedule:

<u>Activity</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Construction	<u>\$62,620</u>	<u>\$36,113</u>	<u>\$ 0</u>	<u>\$-36,113</u>	<u>-----</u>
Total	<u>\$62,620</u>	<u>\$36,113</u>	<u>\$ 0</u>	<u>\$-36,113</u>	<u>-----</u>

III. Performance Summary- Accomplishments

	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>
-Close out Biomedical Isotope Facility project at BNL	\$ 25	\$ 0	\$ 0
-Complete funding for construction of the User Center for Structural Biology at the Advanced Light Source (ALS) in FY 1996.	2,600	0	0
-Complete funding for construction of the Structural Biology Center at the Argonne National Laboratory in FY 1996.	4,295	0	0
-Complete funding for construction of the EMSL at PNNL in FY 1997.	50,000	35,113	0
-Complete funding for construction of the Human Genome Laboratory at LBNL in FY 1997	5,700	1,000	0

EXPLANATION OF FUNDING CHANGES FROM FY 1997 to FY 1998:

-Decrease represents the successful completion of the construction of the EMSL and the Human Genome Laboratory. \$-36,113,000

BIOLOGICAL AND ENVIRONMENTAL RESEARCH
 CAPITAL OPERATING EXPENSES AND CONSTRUCTION SUMMARY
 (Dollars in thousands)

	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>\$ Change</u>	<u>% Change</u>
Capital Operating Expenses					
General Plant Projects (total).....	\$3,488	\$4,837	\$4,811	-\$26	-0.5%
Facility Modifications and Improvements (total).....	0	1,500	0	0	--
Capital Equipment (total).....	20,841	23,525	23,057	-468	-2.0%

Construction Project Summary (both Operating and Construction Funded)

<u>Project No.</u>	<u>Project Title</u>	<u>TEC</u>	<u>Previous Appropriated</u>	<u>FY 1996 Appropriated</u>	<u>FY 1997 Appropriated</u>	<u>FY 1998 Request</u>	<u>Unapprop. Balance</u>
94-E-339	Human Genome Laboratory, LBNL	\$24,634	\$17,934	\$5,700	\$1,000	\$0	\$0
94-E-338	Structural Biology Center, ANL	14,876	10,581	4,295	0	0	0
94-E-337	ALS Structural Biology Support Facilities, LBNL	7,882	5,282	2,600	0	0	0
91-EM-100	Environmental Molecular Sciences Lab., PNL	207,900	122,787	50,000	35,113	0	0
91-E-310	Biomedical Isotope Facility, LBNL	2,325	2,300	25	0	0	0
Total Biological and Environmental Research		XXXXXX	\$158,884	\$62,620	\$36,113	\$0	\$0

