Energy

Increases Over FY 2000 OMB Target
(to nearest $50 million)

1. Defense Program/Tritium Decision +100 - +300

Ratification of the Comprehensive Test Ban Treaty will be a high priority for the Administration, next year; our ratification efforts will not be credible without a rigorous stockpile stewardship program that ensures the reliability of the nuclear stockpile. The tritium decision is an important factor in this debate. Additional funds will be needed to support DOE's tritium production program depending on which option is picked.

2. Climate Change and Energy Technology +100

DOE's energy technology programs are the centerpiece of the Administration's climate change spending initiatives. The Administration successfully fought for increased funding levels in the omnibus appropriations bill, and it is important to follow up with a substantial increase in the FY 2000 budget to maintain momentum and create the technology to reduce emissions without compromising productivity.

3. Environmental Clean-up +1,000

Critical cleanup investments are made by DOE in states such as Washington ($1,117 million), Tennessee ($635 million), Ohio ($533 million), and Colorado ($649 million). The Administration must maintain and increase that commitment over the next two years to support a "National Cleanup Initiative". A stable outyear funding path will also be an important signal to these states.

4. Science +250

DOE is a leader in the President's high-end computing and information technology initiatives. Additional funds are also needed for the Spallation Neutron Source in Tennessee.

5. Oil and Gas +150

To improve energy security, increases are proposed for the Strategic Petroleum Oil Reserve and for oil and gas R&D. We also propose tax incentive initiatives for both energy security and climate change.

6. Russian Initiatives/Counter Proliferation +200

The DOE programs for control and disposition of nuclear weapons material (megatons to megawatts) and for downsizing the Russian Weapons complex (Nuclear Cities) are key components of the President and Vice-President's Russia initiatives. Additional funding is also requested to implement Presidential decision directives on counter proliferation programs such as chem-bio research, counter-terrorism and development and protection of critical infrastructure.

7. All Other +250

We also have a number of needs that total an additional $250 million, among them: civilian radioactive waste; nuclear energy R&D; environmental privatization; and the Elk Hills Settlement with California.

Secretary of Energy Advisory Board

December 4, 1998

Bruce,

T.J. Glauthier thought you would be interested in this report on science education. It contains the observations and recommendations of a committee of outside experts convened to consider the role of the Department of Energy.

These days, this is what I do! Hope all is well.

Skila

Skila Harris

SKILA HARRIS
EXECUTIVE DIRECTOR
SECRETARY OF ENERGY ADVISORY BOARD

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The Honorable Samuel Vigil
Luna Vocational Technical Institute

SUMMARY OF TASK FORCE FINDINGS AND RECOMMENDATIONS:

- The Department's programs in education must be closely linked to its programmatic activity and mission, to the organization of the laboratories and facilities, to the special strengths of those institutions, and to the particular strengths of the scientists and engineers working at the laboratories.

- The Department's collegiate and post-graduate programs are excellent, and the Department is strongly encouraged to continue providing research opportunities for faculty at the college level and beyond as well as for students.

- While celebrating and encouraging the continued success of the collegiate programs, the Task Force identified two further areas of greatest potential contribution for the nation. The first lies in science, math, and technology education at the K-12 level. The second relates to improving the scientific and technological literacy of all Americans.

  - The Task Force encourages the Department to raise the profile of the Science Bowl to broaden its impact.

  - The preparation of teachers constitutes the single most important determinant for the quality of math, science and technology education

  - The Department can make the greatest difference for the greatest number of students by leveraging resources and concentrating on programs which improve the quantity and quality of the Nation's 1.4 million teachers of math and science.

- The Department should seek out opportunities to leverage limited resources by collaborating with other federal agencies, private associations and organizations in sponsoring public events which highlight science education.

- The Department's laboratories are at the forefront of Information Technologies (IT), which put the Department in a unique position to lead the way in making use of its strengths and capabilities in IT for the purpose of education.

- The Secretary of Energy is in a strong position to work with other U.S. government agencies and Departments to improve the level of science education in the United States and to highlight scientific literacy. By speaking publicly about the importance of science, the Secretaary can increase its visibility and help spawn ideas and collaborations across government and with the private sector to improve science, mathematics and technology education.

- The Task Force recommends the Department communicate with its counterpart agencies to assess their views on how best to proceed across government as a whole.

- The Task Force recommends the Department encourage laboratory personnel to become more personally involved and to institutionalize education programs at the laboratories.

- The Secretary of Energy Advisory Board (SEAB) should regularly review the Department's role in education to ensure that it remains an ongoing function, and to track outcomes and results.

Secretary of Energy Advisory Board
Task Force on Education
Washington, DC 20585

December 2, 1998

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The Honorable Samuel Vigil
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The Honorable Bill Richardson
Secretary of Energy
U.S. Department of Energy
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Washington, DC 20585

Dear Secretary Richardson:

The Task Force On Education, a subcommittee of the Secretary of Energy Advisory Board, has now completed its work. I am pleased to convey to you a summary of the Task Force's final recommendations on the Department's role in math, science and technology education. This letter, together with those appended, will represent our final report.

The Department and its predecessor agencies have historically helped attract and train students for careers in science and technology, and wisely so. Strengthening the quality and practice of science, math, and engineering education in the United States is an essential priority for the nation, as the flow of reports pointing to the poor achievement in these areas among youngsters in American schools keeps reminding us. Such investment in education is a benefit not only to the nation but to the Department itself. Given its goals, it is a significant priority for the Department to ensure that the best talent is available to sustain its ongoing mission.

The Task Force hence concludes that the Department's mission to "support continued United States leadership in science and technology" gives it a vital, and indeed urgent, cause for investing in math, science and technology education. The Department's own interest, its ability to carry out its mission, rest on the capacity and creativity of well-trained scientists, mathematicians, and engineers.

The Department of Energy's niche in education is founded in its diverse laboratories and research facilities with their cadre of scientists, engineers and technicians working at the forefront of science and technology. The Department's laboratories and facilities are marvelous adjunct educational institutions and unparalleled resources for bringing people together with the work that is resulting in some of today's greatest scientific and technological advances. The Task Force believes it's imperative for the Department to continue harnessing its extraordinary and diverse scientific

and technical capabilities to address some of the nation's most pressing educational problems.

That said, the Task Force recognizes it is not the Department's mission to fix the problem of science education in this country. Instead, we think the Department should view education as a very important role within its appropriate sphere of activities, focusing on those areas in which it has unique strengths and which can add the greatest value. The Department's programs in education must be closely linked to its programmatic activity and mission, to the organization of the laboratories and facilities, to the special strengths of those institutions, and to the particular strengths of the scientists and other technical experts working there. Programs will obviously differ among laboratories and facilities. Such variety is healthy and reflects the varying kinds of work they conduct and the different communities in which they reside.

An important role for the Department, through your leadership as Secretary, could be to stimulate discussion and collaborations among the several agencies and departments of government which have a major stake in the scientific literacy of the public. We suggest that you may want to consider some communication with your counterparts to assess their views on how best to proceed across the government as a whole.

The role of the Department's headquarters and its field offices in science education should be one of encouragement, coordination, and advocacy for the Department's mission, its programmatic activities, and the importance of education as part of achieving its mission. The Department's headquarters personnel can support these activities across the laboratories and facilities by seeing that programs are evaluated for effectiveness, tracking their overall impact, communicating best practices, and ensuring that those programs are focused and mission-related.

The Task Force adheres to the theory that education best proceeds from the thinking and commitment of those who are actual educators. In this case, working collaboratively with the scientists and others at the laboratories, educators can take advantage of the diverse research conducted by the Department's laboratories and facilities. The Task Force believes these institutions should have the flexibility to craft and carry out education programs that build on their strengths.

The Task Force found the Department's undergraduate, graduate, and post-graduate programs to be excellent. These programs represent critical investments toward the goal of ensuring the availability of a pool of first-rate scientists, engineers, and mathematicians to support the Department's work. We emphatically encourage the continuation of providing research opportunities at the Department's national laboratories and facilities for college level and beyond, faculty as well as students.

While celebrating and encouraging the continued success of the collegiate programs, the Task Force identified two further areas of greatest potential contribution for the nation. The first lies in science, math and technology education at the K-12 level. The second relates to improving the scientific and technological literacy of all Americans.

The Task Force believes the Department's mission justifies its dual role in educating future scientists, as well as in improving the public understanding of science:

- Ensuring a steady flow of scientists directly supports the Department's mission of maintaining a well-trained future laboratory workforce. Students with scientific aptitude should have opportunities at the Department's national laboratories and facilities where they can obtain the specialized research skills and hands-on experience working on projects that are unique to government research and development.

- It is also in the Nation's best interest for the Department to use its resources to enhance public understanding of science. Citizens who have knowledge of science and technology are better-informed voters. The effect is to raise the quality of decision-making and of understanding and support for the Department's multifaceted programs and projects. Everyone learns math and science in grade school, and at this level teachers have an impact on both potential scientists and average students.

The quality of math and science curriculum and instruction is key to both attracting gifted students to science and laying the foundation for basic scientific literacy. The Task Force believes the Department can make an invaluable contribution to the country and ensure its own skill support by harnessing its cadre of technical people and research base to enhance science, math and technology education at the K-12 level. An example of the good use of the Department's resources is its support of the Science Bowl. The Science Bowl attracts the best and brightest students while at the same time raising public awareness of the importance of science education. The Task Force encourages the Department to raise the profile of the Science Bowl to broaden its positive impact.

The Task Force strongly supports programs which directly assist K-12 students, but concludes that, in the end, the preparation of teachers constitutes the single most important determinant for the quality of math, science, and technology education, and represents the single most critical area in which the Department can play a part. The Task Force is convinced the Department can make the greatest difference for the greatest number of students by leveraging resources and concentrating on programs which improve the quantity and quality of the Nation's 1.4 million teachers of math and science.

Appended to this letter is a list of exemplary student and teacher programs at DOE laboratories and facilities. The list contains just a few of the many examples of how the Department's laboratories and facilities make a difference in the quality of science, mathematics, and technology education in their surrounding communities. Undoubtedly there are many more, and we encourage the Department to allow the laboratories and facilities the flexibility to continue and to expand their educational endeavors, and to encourage their pursuit with intensity and focus.

For the Department to make a difference in K-12 education, it must leverage its limited resources through collaboration with other federal and private associations and organizations in sponsoring public activities which highlight science education. Examples include the following programs envisioned by the Department:

- A collaborative effort between DOE and the National Science Teachers Association (NSTA) to implement a mentoring program for teachers. The program aims to recruit 2,000 scientists from DOE's laboratories and facilities to be mentors for K-12 teachers. The program will be on-line and will allow each teacher to develop long-term relationships with a laboratory mentor. The information generated in the electronic communications between mentor and teacher will be collected and maintained on a database by subject area. In this way, other teachers will have access to the information, which will allow much greater dissemination and impact.

- The National Science Foundation (NSF) and DOE plan to form a partnership to enhance teacher capabilities and improve science, math, engineering, and technology education in the United States. The NSF is interested in using DOE's laboratories for research-based professional development for high school teachers to expose them to scientists in a research environment in the belief that this will enhance their knowledge content and thus make them more effective teachers.

Another example is the Department's participation in the science and technology aspects of the White House's Millennium Project.

Obviously most collaboration is going to occur at the laboratory level and be characterized by cooperation with local institutions. Therefore, the Department should encourage the private contractors who work at its sites to be substantially involved in educational efforts in their surrounding communities. These efforts should be well coordinated with the programs at the laboratories and facilities. The greater the number of people and organizations involved, the more leverage and impact the programs will have. In addition, the laboratories' expertise in technology privatization should be encouraged for educational efforts.

The Task Force would also like to mention the potential role of the Department's laboratories in Information Technology (IT). The Task Force believes IT will radically alter the way information is delivered and the way teaching occurs, just as IT has already altered the way education is delivered. IT has the potential for stimulating more rapid and robust learning, for providing greater dissemination of information, and for affecting many people (i.e. anyone who has a computer). Since many of the Department of Energy laboratories are at the forefront of IT, the Department is in a unique position to lead the way in making use of its strengths and capabilities in IT for the purpose of education.

As Secretary of Energy, you are in a strong position to work with other U.S. government agencies and Departments to improve the level of science education in the United States and to highlight scientific literacy. Just by speaking publicly about the importance of science education you can increase its viability as an issue and help spawn ideas and collaborations across government and with the private sector to improve science, mathematics and technology education. The Task Force recommends several actions you might undertake in support of the Department's efforts.

We suggest that you request reports from the Laboratory Directors on their education programs and solicit their ideas for new initiatives on a quarterly basis. Top-down encouragement and a more flexible policy environment are sometimes required to persuade people to become more personally involved and to institutionalize education programs at the laboratories. We also suggest that you ask the Secretary of Energy Advisory Board regularly to review the Department's role in education to ensure that it remains an ongoing function, and to track outcomes and results.

Finally, as the Country marks the twenty-fifth anniversary of the Arab Oil Embargo, we are reminded of the importance of energy security and the essential role energy plays in our daily lives. During its deliberations and discussions with the public, the Task Force found that neither the Department's energy mission -- nor its other missions -- are well known or understood. This lack of pubic awareness and understanding deprives the public of important information and weakens the policies for which the Department is responsible.

In the Task Force's view, Secretarial leadership and commitment are required to promote greater public understanding of the Department's missions, including the science it conducts, and the relationship between the Department's work and the future of the Nation. The central idea of public understanding of science is for citizens to understand how science works, why it matters, and how some of the critical problems the Department of Energy faces in carrying out its mission affect people's lives.

The Task Force very much appreciates the opportunity to provide these comments on the Department of Energy's role in education. We wish you the very best for the tasks that lie ahead.

With best wishes,

Yours sincerely,

Hanna H. Gray

Hanna H. Gray
Task Force Chair

cc: Dr. Walter Massey
Chairman, Secretary of Energy Advisory Board

ATTACHMENT A: DOE LABORATORY PRECOLLEGE PROGRAMS

The following are brief descriptions of exemplary precollege activities at several of the Department's laboratories:

ARGONNE NATIONAL LABORATORY

Precollege activities focus on teachers from middle school/junior high and high schools. Teachers participate in research with laboratory scientists or are involved with programs by which they can enhance their science and technology content knowledge, and have a positive impact on student learning.

BROOKHAVEN NATIONAL LABORATORY

Teacher's Research Associates (TRAC) Program -- teacher enhancement program focused on science content and based on the laboratory's research. Emphasis is on providing actual research participation for secondary teachers and science immersion experiences for primary teachers. The aim is to develop the teachers' critical perspective not only on content but also on the methods of inquiry used in actually doing science and technology, and empower them to apply this in their teaching.

Integrating Mathematics, Science, and Technology (MST) in the Elementary Schools Program -- a partnership between the Department and the National Science Foundation for teacher professional development. The laboratory compliments the effort of specialists in teacher education at two universities to reinforce new pedagogy by displaying its linkage to the actual practice of teaching, and supporting classroom implementation. This program pre-dated and influenced the issuance of new state learning standards in MST, several of which are now research-based.

FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB)

Fermilab is the nation's premier laboratory for particle research. Part of doing physics always has meant teaching physics, and Fermilab is a teaching laboratory, committed to improving science literacy, communicating the nature and value of basic research, and training the next generation of scientists. The Laboratory's open site and low hazard level make it accessible to students, teachers and visitors; and the Leon Lederman Science Center provides a Teacher Resource Center and hands-on physics learning center for younger students

The Leon Lederman Science Education Center at Fermi National Accelerator Laboratory (Fermilab) has been a crucial element in the DOE supported involvement in the Chicago Public Schools. Through Fermilab and Argonne National Laboratory, DOE initiated the Teachers Academy for Math and Science, which is now in 75 Chicago public schools, engaged with intensive in service retraining of over 3,000 primary school teachers in the Chicago area. Teacher Academy personnel, with strong Fermilab leadership, spend approximately 120 hours a year of contact time with each teacher, supervising how they teach, and advising them how to be more effective teachers of science. The Task Force believes the cost of $3,000 a year per teacher is not prohibitive and is a good investment, given the fact that there is substantial evidence demonstrating that the Center's efforts have led to improved standardized test scores in many of the poorest schools in Chicago.

Saturday Morning Physics Program - For 20 years, outstanding physics students from area high schools have come to Fermilab for 10 weeks of Saturday Morning Physics. Organized, operated and taught by laboratory physicists, the program offers three 10-week sessions each year.

LInC - a unique course for K-12 teachers that helps them use World Wide Web technology to support problem-based learning. Fermilab offers the course either face to face or on-line. Teachers develop classroom projects.

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

INEEL Science Action Teams - A Science Action Team consists of a high school science teacher, a teacher-in-training, 3 to 5 students, and a scientist or engineer from the Idaho National Engineering Laboratory (INEEL). The team spends 8 weeks during the summer solving a real life research or engineering problem at the INEEL. Participants gain access to the considerable resources of the laboratory, which enhances a greater understanding of research methodology and discovery as well as career exploration that occurs in the classroom. Teachers and students are directly involved with INEEL personnel that focus on solving critical problems related to energy production and application, the environment, U.S. Economic competitiveness, and national security. Participants earn University credit for the experience as well as a stipend. Successful teachers can come back to the laboratory to learn to transfer the SAT experience back into the classroom through our *Teaming Teachers with Industry* Program.

Teaming Teachers with Industry - Teaming Teachers with Industry (TTI) is based on the teachers practical internship at the INEEL. Master teachers instruct in the "Solutions Model" that shows how to transfer their experience into the classroom by providing modeling techniques, training, teaching tools, and follow-up support for implementing a new project-based way to teach science. Follow-up support is provided to the teachers as they transfer the Solutions Model into their classroom, thus enabling their students to engage in learning that reinforces and makes relevant the academic delivery of instruction. A strong partnership with the Idaho State Department of Education ensures the model can be adapted to fit the specific educational requirements of each school and/or district.

Both of these programs are highly leveraged with other than DOE funding. Sponsors include the Office of Naval Research, Idaho School-to-Work, JTPA, and The Albertson Foundation.

E. O. Lawrence Berkeley National Laboratory

Hands-on Universe - provides students with a technology-based astronomy learning environment including access to an automated telescope. As a result of this program two high school students were co-discoverers of a supernova. About 200 teachers and 6,000 students are touched by the program, and has enhanced interest in science.

Curriculum and Technology Development for the Precollege Environment -- curriculum development projects that call on the leading information at Berkeley lab are used around the world and attract additional support. The Standard Model of Fundamental Particle and Interactions Wall Chart is being used to teach elementary physics in almost very country in the world. Examples of curriculum areas: Contemporary Physics Education Project, Whole Frog Project, Microworlds.

Lawrence Livermore National Laboratory

Laser Science and Optics for the Classroom (LSOC) program is developing lessons about laser science and optics technology for incorporation into high school science and mathematics curricula. Unlike most curricula that have a single discipline emphasis, each LSOC lesson is connected to a mathematics lesson creating a cross-disciplinary curriculum platform exemplifying the integration of science and mathematics instruction. LLNL is a world leader in laser/optics science, engineering, and technology as part of its mission-directed science in support of Defense Programs (DP)

Stockpile Stewardship Program. With this unique set of resources, LLNL is partnering with the San Francisco Exploratorium, the San Jose Tech Museum, San Jose State University, Los Angeles Unified School District, Fresno Unified School District, and Las Positas Community College to develop LSOC lessons that are activity based. These lessons spiral from grades 9 through 12 and use lasers and optics materials as tools to support learning in physical science, life science, chemistry, and physics. Thirty teachers are now pilot testing these new science and math lessons in their classrooms.

LLNL's Science on Saturday is a eight week series of Saturday morning presentations about research in a variety of disciplines being conducted at LLNL and other R&D organizations. Topics provide up-to-date information on research and new developments in a variety of scientific fields. The free lectures are provided by scientists and engineers from state-of-the-art facilities from around the country. Science on Saturday, which started in 1997, has attracted each year during February and March over 2,000 enthusiastic participants, primarily middle-school and high-school students along with numerous parents and teachers. Examples of Saturday lectures in 1998 that illustrate the breadth of topics include Dr. Russell Hulse, 1993 Nobel Laureate in Physics from Princeton Plasma Physics Laboratory who presented "An Astronomical Detective Story: The Discovery of the Binary Pulsar" and Dr. David Nowak from LLNL who presented "Making Computers Fast!". Due to its overwhelming success, Science on Saturday is a continuing program which is supported by LLNL infrastructure funds to enhance public literacy in science, mathematics, engineering, and technology.

LOS ALAMOS NATIONAL LABORATORY

New Mexico Supercomputing Challenge -an academic-year long program in which teams of one to five high school students and their sponsoring teachers conduct computational science projects using high-performance computers at LANL. The program includes a two-day Kickoff Conference with workshops and training in the fall, Laboratory mentors for each team, site visits by Laboratory personnel at least twice during the academic year, a two-day visit to the Laboratory in the spring, and summer teacher training workshops.

Teacher Opportunities to Promote Science (TOPS) -a three-year teacher development program for teachers of grades 4-12 from rural New Mexico schools to enhance their math, science and technology teaching skills. Teachers are recruited as multi-level teams from districts, and from specific geographical areas, so that the teachers have a local peer group to work with. Each year, approximately 65 teachers participate and work side by side with the school districts and administrators to promote systemic change in the way math and science are taught. Through hands-on activities, research

experiences in laboratory-related cutting-edge science, and a methodology that helps them transfer their program experiences to the classrooms, this program provides teachers and students with an exposure to innovations and applications in real world science.

Educational Networking Support (EduNets) - This program was developed to respond to the national goal of having every school connected to the "Information Highway" by the year 2000. Its mission is to help get school classrooms, libraries and offices connected to Internet resources on science, math, engineering and technology, and to provide training for teachers, administrators, and technical support teams to use these resources in the schools. A major emphasis is on the total integration of these resources and tools into the classroom and into the curriculum. A team of LANL experts helps schools design, purchase, and install the necessary hardware and software. The team then holds workshops in the schools or regionally to train the teachers and administrators in the use of the resources. Local technical teams are trained to be the maintenance and help infrastructure in the region. Often the local community colleges are used as a hub, both for interconnection to the Internet, and for technical help. K-12 schools are then connected through the community colleges, giving the colleges a natural "recruiting" connection to the schools, and the schools a continuing source of technical help.

New Mexico Supercomputing Challenge - an academic-year project in which teams of one to five high school students and their sponsoring teachers conduct computational science projects using high-performance computers. Typical participation in a single year is 550 students in 120 teams, and about 85 teachers.

OAK RIDGE NATIONAL LABORATORY

The Ecological and Physical Sciences Study Center provides mission-related, standards-based, hands-on programs for students and teachers on such topics as: "Fun with Fossil", and "Birds of Prey".

Appalachian Regional Commission (ARC) Summer Honors program -- provides 2-week research immersion experience for 46 students from 13 Appalachian states.

Project SEED - program co-sponsored by the American Chemical Society which provides summer research experiences for economically disadvantages high school students.

Adventures in Supercomputing (AiS) - the goal of this program is to foster and enhance the participation of women, minority, and rural elementary through high school students in mathematics, science and computing by preparing teachers to provide an interdisciplinary approach to a project-based curriculum

ARC Teachers Program - a two-week mentored research experience for high school teachers from the Appalachian region.

Teacher Research Participation Program (TREP) - provides 8-week summer research experience for middle and high school teachers.

PACIFIC NORTHWEST NATIONAL LABORATORY

Student Research Apprenticeship Program (SRAP) - This project targets students who are under represented in the science, mathematics and technology pipeline. High school students with a background in science and mathematics and an interest in and potential for a career in science and mathematics are provided research appointments at Pacific Northwest. They are placed with a scientist, engineer, or technical specialist. Students work 4 days each week in the Laboratory and spend the fifth day participating in educational enrichment activities, which are guided by a teacher/counselor.

Scientist-Student-Teacher (SST) High School Research Project - This project brings teams of high school teachers and their students to the Laboratory to participate in specific research projects that support the Laboratory's science and technology mission and connect to the school's existing curriculum. Teams return to their high schools and continue to contribute to the Laboratory's research through a junior/senior level research course which is established at each high school. The National Science Foundation is a partner with Pacific Northwest and Associated Western Universities in this project. In the summer, teams work 4 days each work on their research in the Laboratory and spend a fifth day participating in enrichment activities designed to facilitate the transfer of the research to the classroom. This project incorporates elements of DOE's Teacher Research Associates Program.

Teacher Development Partnership for Arid Lands Stewardship (PALS) Teacher Leadership Institute - This project brings teams of K-12 teachers to the Laboratory for simulated research experiences and intensive workshops designed to develop a cadre of teacher leaders in science education. The simulated research projects immerse teachers in learning experiences that parallel the way scientists study the ecology of arid lands. Workshops assist teachers in their efforts to integrate their ecological content knowledge with knowledge of learning, pedagogy, and students to create standards-

based projects that enhance the school curriculum.

National Teacher Enhancement Project II/Science Alive Technology Project: Leadership Institute Integrating Internet, Instruction, and Curriculum (LinC) - This is an innovative approach to instruction designed to challenge teams of educators to create engaged learning projects that incorporate the best use of technology. Following three years of field and laboratory work on local ecosystems through the Laboratory's Science Alive program, a team of teachers from Pacific Northwest (along with 6 other DOE Labs) is now participating in this on-line course offered by Fermilab. As a part of the project, Pacific Northwest teachers will create on-line classroom projects based on real laboratory data on the aquatic and terrestrial ecosystems of the Columbia Basin. The on-line course further leverages Science Alive which is closely aligned with Washington State's efforts to create a cadre of elementary science teacher leaders who can participate in its statewide effort to reform science, mathematics, and technology education. Use of information technology to improve teaching and learning is a key strategy in this statewide effort.

Materials Science and Technology - Teams of teachers and administrators work with Laboratory researchers in materials science and technology. Teams enhance their knowledge of the nature and behavior of materials and take part in hands on activities that can be replicated in classrooms. A Materials Science and Technology course, on which teacher training is based, was developed by Pacific Northwest staff and Northwest teachers. The course has received regional and national recognition, including endorsement by the U.S. Materials Education Council.

Note on Evaluation : Pacific Northwest conducts ongoing evaluation of all its projects. Impacts on participant knowledge and skills are measured for each project. Additionally, teachers' assessments of their ability to transfer their Laboratory experiences into classrooms are gathered. Pacific Northwest uses a variety of formative evaluation tools in its efforts to continually improve the quality of its programs.

PRINCETON PLASMA PHYSICS LABORATORY

Plasma Physics and Fusion Energy Institute - a summer Plasma Camp in which high school teachers design and run experiments, analyze data, and work in teams with PPPL scientists to integrate what they learn into their school curricula. In addition, PPPL has developed the Interactive Plasma Physics Experiment in which teachers and students work collaboratively with scientists over the Internet on an interactive virtual fusion reactor.

SANDIA NATIONAL LABORATORIES - CA

SUPER! (Science Understanding Promotes Environmental Responsibility) - Combining Sandia's unique scientific and technological excellence with the educational expertise of the Lawrence Hall of Science and the K-12 Alliance, the SUPER! Institute provides middle and high school teachers with insight into the science concepts behind national security issues and their environmental impact. SUPER! includes an intensive three-week summer Institute and year-round activities during which teachers explore topics ranging from the dismantlement of the nuclear stockpile, groundwater remediation strategies and integrated manufacturing, to the effective use of technology (i.e., the Internet) and issues around risk. Teachers learn how to help students understand that science is basic to surviving in today's complex world and return to their classrooms to advance scientific literacy by combining state of the art science with innovative teaching strategies.

2020 Vision Program - The 2020 Vision program introduces students and teachers to national security issues. It is an increasingly Web-based program that reaches more than a dozen teachers and several hundred high school students across the country. Through a technique called scenario building, teams of students develop stories about the future of the United States and different regions of the world, considering how international developments might affect U.S. national security over the next 20 years. The students provide DOE and Laboratory planners with an alternative, youthful perspective on national security issues, a perspective sometimes lacking in traditional strategic planning circles. In the past year, a mentor program, enhanced teacher training, and an online discussion room have been added to the program.

LASER - Partnering Sandia National Laboratories/California leading edge technology with statewide educational organizations and the Lawrence Hall of Science, LASER provided teachers with training in science content, pedagogy, and leadership to ensure their confidence, commitment and competence in teaching science. This professional enhancement program provided teachers with insight into a breadth of topics being dealt with at Sandia in relation to national security which gave real world applications to science concepts. LASER also assisted in developing a district infrastructure that will continue to improve inquiry-based (i.e., hands-on) science in elementary education post-LASER by working with all customers and stakeholders in the district including parents, all levels of administrators, and other teachers.

LASER has been honored with awards from the school district, the K-12 Alliance (California's systemic reform organization) and most recently the President's Quality Award (PQA) by Sandia National Laboratories for significantly enhancing the quantity

and quality of science instruction taught in its participating school district. PQA is Sandia's internal version of the Malcom Baldrige National Quality Award. The gold level is particularly prestigious in that since the inception of the Sandia PQA in 1992, only one had previously been awarded at the California and New Mexico sites combined.

SANDIA NATIONAL LABORATORIES - NM

Advanced Manufacturing -This program is designed to develop technicians in the local school system capable of supporting the Sandia advanced manufacturing activities and replaces an intensive Sandia apprenticeship program. It is a partnership with West Mesa High School and the Technical Vocational Institute (TV-I), a local community college. Through this program a special core curriculum has been established at West Mesa High School, with an emphasis on mathematics, applied physical sciences, computer aided drafting, design and manufacturing, materials processing and machining, and manufacturing technology projects. The program is in its third year of operation and formally established at West Mesa High School as the Advanced Technology Academy. Exceptional students participating in the program are eligible for a summer internship at Sandia. During the summer of 1998, twelve Advanced Technology Academy students interned at Sandia in the Manufacturing Technology Center.

University Pre-Service Program -This is a multi-year collaboration with the University of New Mexico's College of Education and College of Arts and Sciences to develop a pre-service hands-on, integrated science curriculum for K-8 teachers that meets recognized science content and instructional standards. The science curriculum developed by this program is a three course sequence integrating physics, chemistry, biology, and geology content with the appropriate pedagogy for hands-on science instruction. The curriculum is established at UNM and required for all K-8 teachers. Approximately 400 students per year are enrolled in this course sequence. For FY98, Sandia joined in a partnership with the NM Commission of Higher Education and Southwestern Indian Polytechnic Institute (SIPI), a Native American community college, to establish the same three course science sequence at SIPI. The first course in this sequence will be initially offered in September 1998, and successful graduates from the SIPI program may transfer to UNM to complete their baccalaureate education degree. This effort is supported with Sandia indirect funds.

SAVANNAH RIVER SITE

National Resources Science, Mathematics and Engineering Education Program - The objective of this program is to enhance science, math, and engineering interest and abilities, particularly among women and minorities. In 1997, the program provided over 15,000 student visits from 12 different counties/school districts. Students in grades 3-12 have an opportunity to learn science, math, and engineering principles in a "hands-on" setting. The relevance of math and science principles is highlighted and reinforced through activity-based exercises such as sampling and measurement of plant and animal communities, investigation of soil and weather chemistry, and surveying.

The Traveling Science Demonstration Program - a pilot project providing 12 kits for teachers and students to have access to up-to-date science equipment, allowing more hands on science activities.

School to Work Program - provides formal training combining supervised work and classroom education. The program offers students exposure to state of the art technology and computer skills starting in high school and continuing into higher education.

Previous Two Letters from the Task Force on Education to the Secretary of Energy

Dr. Hanna H. Gray, Chair

Secretary of Energy Advisory Board
Task Force on Education

Washington, DC 20585

June 5, 1998

Dear Secretary Peña:

The Task Force on Education is one-half of the way into its nine-month term. In this time, we have arrived at some initial conclusions we would like to share with you.

Among your charges to the Task Force was to provide an evaluation of the Department of Energy's programs in math, science and technology education. As you know, most of the Department's education programs are at the university-level and conducted by the Department's laboratories, or through university programs sponsored by the Department.

The Task Force has seen and heard ample evidence demonstrating that the Department's undergraduate, graduate and post-graduate programs offer important support to the Department's missions, and are vital to the Nation's technological and economic future. These programs provide students and teachers with hands-on learning, contact with outstanding scientists and engineers, and the opportunity to work with problems unique to the public sector -- experiences crucial to the development of the Department's and the Nation's future scientific workforce.

The Task Force members share a consensus that the Department's laboratory system in general serves as a marvelous educational resource for this Nation and that the laboratories can play a special and unique role in the educational and professional development of undergraduate and graduate students. It is our judgement that failing to expand and improve the use of these resources across the system to support science education in this Nation would be shortsighted given the success of these programs to date.

While celebrating the success of the undergraduate, graduate and postgraduate program, the Task Force is deeply concerned about science education at the K-12 level, and the general scientific and technological literacy of all Americans. While we as a Nation react to test

results that remind us of this dilemma, solutions to these interrelated, complex problems continue to elude society. Addressing them in full goes far beyond the scope of this Task Force. However, we believe that the necessary key to addressing these problems is a continuous, sustained effort, of which one important element lies in teacher education and professional development, and in raising the prestige and diversity of the teaching profession.

The Task Force will continue to analyze and evaluate DOE's education programs, and will provide more specific advice and recommendations in succeeding months. Our focus will continue to be on where DOE can make a difference, given its limited resources. One point which has been often made is that the Department's education program must strive for stability and continuity, and that it must have the strong support of the Secretary and of the laboratories. We strongly concur with this statement, and suggest this priority be passed on to the Secretary-designate.

Ultimately, the Task Force will submit recommendations for a well-defined, focused program, building on the specific strengths and goals of the Department and its laboratories. The structure of such a program should be both variegated and stable, one that will accommodate growth and increased functions while retaining its core mission. The Task Force would like to help the Department create a roadmap for the education program.

We thank you for allowing us this opportunity to provide some of our preliminary findings. We look forward to providing you and the Secretary-designate with more recommendations, and a potential roadmap for the Department's education programs.

Sincerely,

Hanna H. Gray

Hanna H. Gray
Task Force Chair

cc: Dr. Walter Massey
Chairman, Secretary of Energy Advisory Board

Dr. Hanna H. Gray, Chair

Secretary of Energy Advisory Board
Task Force on Education

Washington, DC 20585

September 3, 1998

The Honorable Bill Richardson
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Secretary Richardson:

In January 1998, Secretary Peña directed the Secretary of Energy Advisory Board to form a Task Force on Education with the mandate of advising him on the Department of Energy's role in strengthening mathematics, science, technology and engineering education in the United States.

In June, the Task Force conveyed its initial findings by letter to Secretary Peña. It reported its judgment that the programs for undergraduate and post-graduates historically supported by the Department had made a significant contribution to training and to attracting promising young scientists to work in the national laboratories. The Task Force expressed concern about the elimination of funding in FY 1999 for some of the programs that had proved so successful and recommended that the Department take action to secure appropriation of funds to continue those efforts.

At the same time, the Task Force emphasized the importance of addressing problems in math, science, and technology education at the K-12 grade level and indicated that its next period of inquiry, evaluation, and discussion would focus on identifying appropriate roles for the Department in this category. Hence this letter addresses the Task Force's recommendations on how the Department might best contribute to K-12 math and science education.

While the Task Force supports the ongoing initiatives within the Department that directly assist K-12 students, it concludes that, in the end, the preparation of teachers constitutes the single most important determinant for the quality of math, science, and technology education and represents the single most critical area in which the Department can play a part. We are convinced that the essential way of making the greatest difference for the greatest number of students is to leverage resources and concentrate on programs that improve the quantity and quality of the Nation's 1.4 million teachers of math and science.

We take it as a given that the task of enhancing the capacity of math, science, and technology education in our nation is enormously complex and that it requires ultimately a strengthening of the Nation's educational standards as a whole together with the enhancement of the prestige of the teaching profession itself in order to attract and retain the very best educators. For its part, the Department should select carefully what it can do best and concentrate its efforts where it can contribute most, within the context of its own distinctive mission.

In the Task Force's view, the Department of Energy's niche in education is founded in the national laboratories. A great wealth of knowledge and capacity is embedded in the Department's extensive system of research facilities and in their cadre of scientists, engineers and technicians who are working at the forefront of the scientific enterprise. Through these institutions, the Department can offer unique experiences and unusual opportunities to seasoned teachers as well as teachers in training.

In the past, many of the Department's teacher programs focused on bringing teachers to its laboratories in order to enhance their scientific knowledge. Under the Teachers Research Associates (TRAC) program, teachers would spend one to three summers at DOE laboratories where they interacted with scientists and conducted research. Teachers who completed this program testified they had obtained a deeper understanding of science and of scientific research and that their teaching of math, science and technology had been very greatly improved as a result.

Along the same lines, the Department has been engaged in a five-year collaboration with the National Science Foundation (NSF) to enhance teacher education. The National Teacher's Enhancement Program (NTEP) has brought science teachers to the laboratories to work with scientists in solving real problems in science and technology. This program has provided teachers experience in how science is conducted, and has improved their science teaching skills. Although the grant for this particular program recently ended, the Task Force strongly encourages the Department to collaborate in these types of efforts.

The Task Force also has seen and heard ample evidence demonstrating that specific teacher education programs at individual DOE laboratories have made a significant impact in the communities they serve. We would like to point out that much of the funding for these programs comes from the laboratories' discretionary budgets. Many of the examples involve collaboration with non-DOE partners to leverage existing resources and to lessen the financial burden on any one participant. Several examples the Task Force would like to single out include:

- Princeton Plasma Physics Laboratory (PPPL) runs a summer Plasma Camp, officially titled the Plasma Physics and Fusion Energy Institute, in which high school teachers design and run experiments, analyze data, and work in teams with PPPL scientists to integrate what they learn into their school curricula. In addition, PPPL has developed the Interactive Plasma Physics Experiment in which teachers and students work collaboratively with scientists over the Internet on an interactive virtual fusion reactor.

- Sandia National Laboratories runs a Leadership Academy for Science Education Reform (LASER), a collaborative effort in which Sandia provides technical expertise, and its partners provide teaching lessons. The teachers spend fifteen days during the summer, and eight days during the school year immersed in science and learning various technical scenarios such as characterizing sensors associated with the nuclear weapons dismantlement. The school districts provide the teachers who attend the program with four and a half days to instruct the other teachers in their districts. In all, the program affects about 150-200 teachers per year.

- The Leon Lederman Science Education Center at Fermi National Accelerator Laboratory (Fermilab) has been a crucial element in the DOE supported involvement in the Chicago Public Schools. Through Fermilab and Argonne National Laboratory, DOE initiated the Teachers Academy for Math and Science, which is now in 75 Chicago public schools, engaged with intensive in service retraining of over 3,000 primary school teachers in the Chicago area. Fermilab personnel spend approximately 120 hours a year of contact time with each teacher, supervising how they teach, and advising them how to be more effective teachers of science. The Task Force believes the cost of $3,000 a year per teacher is not prohibitive and is a good investment, given the fact that there is substantial evidence demonstrating that the Center's efforts have led to improved standardized test scores in many of the poorest schools in Chicago.

In addition, the Department has launched a collaborative effort with the National Science Teachers Association (NSTA) to implement a mentoring program for teachers. The program aims to recruit 2,000 scientists from DOE's laboratories to be mentors for K-12 teachers. The program will be on-line and will allow each teacher to develop long-term relationships with a laboratory mentor. The information generated in the electronic communications between mentor and teacher will be collected and maintained on a database by subject area. In this way, other teachers will have access to the information, which will allow much greater dissemination and impact.

These are just a few of the many examples of how the Department's laboratories can make a difference in the quality of science, mathematics, and technology education in their surrounding communities. Undoubtedly there are many more, and we encourage the Department to allow the laboratories the flexibility to continue and expand their educational endeavors. However, the Task Force also believes that DOE headquarters should be responsible for evaluating the programs for effectiveness, tracking the overall impact of the programs, and communicating best practices among the laboratories and to the outside world. DOE headquarters should be particularly involved in collaborative programs which are national in scope in order to keep track of outcomes and to make any necessary improvements.

The Task Force recommends the Department move to reinstate programs such as these that support teacher enhancement. We would, however, suggest that these programs be open not only to teachers already in service but to teachers in training as well. We think also that participants should be required to serve as resources within their schools or school districts upon completion of the program, in order that more teachers and students be able to benefit.

The cost to DOE of such a program might be mitigated through collaboration with other organizations. For example, the Department of Energy laboratories could provide the facilities and the scientific and technical personnel while other organizations, such as the National Science Foundation, professional associations, and private foundations could provide funding for teachers to spend a summer or semester at a laboratory.

The Task Force believes that the Department's mission to "support American leadership in science and technology" gives it a vital, and indeed, urgent cause for investing in the future of math and science education. The Department's own interest and ability to carry out that mission rest on the capacity and creativity of well trained scientists and engineers. Advances in science and technology increasingly drive the larger economy and make possible the contribution that the Department of Energy can make to our national well-being.

The Task Force would again like to stress that the Department's role in education, to be effective, will depend above all on the strong support of the Secretary speaking to the importance of science education when he addresses laboratory personnel, Congress, and in many other opportunities. The Secretary's activism will surely buoy the efforts of thousands of scientists who work in and make use of the National Laboratories. We reiterate, too, that the Department's program in education, if it is to have lasting results, must strive for continuity and stability while always holding to rigorous standards and focused aims.

The final meeting of the Task Force is scheduled in Washington on September 18th. We expect shortly thereafter to submit to you our final recommendations for a well-defined program that will build on the specific strengths and goals of the Department and its laboratories.

Thank you for giving us this opportunity to share with you some of our interim findings. We look forward to providing you with our final recommendations and a potential roadmap for the Department's programs in education.

With best wishes,

Yours sincerely,

Hanna H. Gray

Hanna H. Gray
Task Force Chair

cc: Dr. Walter Massey
Chairman, Secretary of Energy Advisory Board

Dr. Gerry Wheeler
Executive Director, National Science Teachers Association

Dr. Rita R. Colwell
Director, National Science Foundation