DOE/DP/48075--8

DE93 005144

Attachment 5

U. S. Department of Energy Grant DE-FG07-89DP 48075

CONF-920307--91

IMPLEMENTATION STATUS OF THE DOE OFFICE OF TECHNOLOGY DEVELOPMENT STRATEGIC PROGRAM PLAN FOR ENVIRONMENTAL EDUCATION AND DEVELOPMENT

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ABSTRACT

This paper displays DOE's environmental education and development mission, goals, and strategy; and describes progress in and plans for implementing this strategy.

INTRODUCTION: DERIVATION OF DEPARTMENT OF ENERGY (DOE) ENVIRONMENTAL EDUCATION AND DEVELOPMENT PROGRAM FROM NATIONAL AND AGENCY MISSIONS

With the November 1989 formation of the Office of Technology Development (OTD) within the Office of Environmental Restoration and Waste Management (EM) came the responsibility to develop programs to ensure that enough trained and educated people would be available to support the achievement of EM's 30-year goal. This mission responsibility derives from public policy and Departmental environmental management requirements. The February 1991 report of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) Committee on Education and Human Resources displayed the first ever Federal crosscut of initiatives for implementing the mandate championed by the 1989 Berkeley Conference that "By the year 2000, U.S. students will be first in the world in science and mathematics achievement."

Within DOE, urgency to move forward resulted from the assumptions (1) that the current workforce was insufficiently prepared for the transition from a production mission to a mission of environmental compliance and cleanup; and (2) that, given current trends and forecasts, the national education infrastructure was unlikely to yield the scientists, engineers, and technicians to meet future DOE workforce needs, especially in the case of women and minorities who, projected to make up two-thirds of the net entering workforce by the year 2000, have traditionally been least prepared for and inclined to enter scientific and technical fields.

Responsibility for scoping and solving these problems became the job of the Environmental Education and Development Branch (EED) of the Technology Integration and Environmental Education and Development Division. In July 1991, EED drafted a Strategic Program Plan to define its mission, goals, and strategic program elements. The Plan (DOE/EM-0058P) formally published in December 1991, clearly articulates three elements requiring support--the education pipeline (K-PhD), the development of the current workforce, and public environmental literacy. The knowledge required to create a proper EED "recipe"--how much of what parts of which elements should be combined--is being developed in two ways: first, through both a national and a site-specific manpower supply and demand study; and second, through an inventory of education and development programs already in place within DOE and other Federal agencies.

ENVIRONMENTAL EDUCATION AND DEVELOPMENT MISSION AND 30-YEAR GOAL

The mission of the Environmental Education and Development Program is to retain and retrain the current generation, and to attract and train the next generation of employees for developing and implementing solutions to DOE's Environmental Restoration and Waste Operations problems. The 30-year goal is to have played the primary role in collaborating with the education and training communities to develop a scientific, technical, and educational infrastructure that not only will have achieved the compliance and cleanup goals of DOE's first Five-Year Plan, but that can prevent most subsequent DOE environmental problems and routinely solve the rest.

Immediate and Five-Year Goals for Meeting EED 30-Year Goal

The Environmental Education and Development Program must continually (1) assess the EM-30, EM-40 and EM-50 current and near-term demand for, and the local and national supply of, people appropriately trained and educated to achieve DOE's goals of compliance on an accelerated basis and cleanup of the current (as of 1989) inventory of inactive sites by the year 2019. The first iteration of this assessment is underway and should be completed by April 1992.

Over the next five years, EED must (2) implement programs based on the initial assessment to create an adequate manpower supply, particularly the supply of underrepresented groups (women, minorities, educationally disadvantaged). In the short term, progress will depend critically

on retraining personnel already or shortly available who have related technical backgrounds but little direct experience in cleanup. The change in mission at some DOE sites opens a particularly timely opportunity to involve these experienced technical and management people in the EM mission. EED must (3) reassess this manpower demand and supply annually as part of EM's Five-Year Plan process and tailor its programs accordingly and then (4) institutionalize programs as soon as possible. Most programs should stand alone after appropriate EM-50 support. Finally, EED should (5) review all the job categories that are involved in EM activities, including not only in the technical disciplines normally considered, but also those associated with other critical players such as managers, lawyers, and economists.

EED Intermediate Goals : 5-10 Year Goal

To have influenced the current workforce and the education and development infrastructure to have provided EM-30 with the people it needed to bring facilities into compliance with applicable laws and regulations, and to have provided EM-40 with the people it needed to achieve Records of Decision (RODs) for its 1989 inventory of inactive sites. (Given that about three-fourths of DOE's inactive sites have yet to be characterized, we make the assumption that it will take 10 years before all sites are through the ROD.)

15-30 Year Goals

(1) To have provided EM-40 with the people it needed to design and begin to implement all necessary remedial actions, and to have provided EM-30 with the people needed to design, build, and operate treatment/storage/disposal facilities for EM-40 wastes. (2) To have provided EM-30 and EM-40 with the people needed to complete the backlog of soils remediation projects and conduct post-closure monitoring. (3) To have provided EM-40 and EM-30 with the people needed to complete all ground water remediations except those at the Hanford Reservation (including the remediation of single-shell tanks). (4) The 30-Year goal has already been stated. By this time, EM-40 will no longer exist, or will exist only to conduct routine decontamination and decommissioning and post-closure monitoring. Technologies and people yielded through EM-50 activities routinely solve EM-30 problems before or as they arise.

BENEFITS OF A FLEXIBLE EED PROGRAM STRATEGY

The innovative, evolving EED program strategy is to capture, channel, challenge, and commit people to working on the EM job by intervening at every source of actual or potential manpower, with continual analysis year by year to direct the program towards meeting both immediate and long-term workforce needs.

Setting the Stage

From its inception late in 1989, EED has employed an analogue to the "observational approach" increasingly used by remediation contractors. Rather than exhaustively characterizing a problem before starting to solve it, this approach emphasizes designing proposed changes to satisfy the most probable conditions, then observing deviations and modifying the approach as needed. EED will thus be able to take advantage of insights gained along the way to make continuous adjustments according to emerging results.

The virtue of this approach is that it was important to be ready to fine-tune something already in place rather than have to start from nowhere after waiting upon survey results. The orchestra, so to speak, has been put in place; it's now a question of what the score will be. An important activity has been coordinating with other DOE and other Federal agency work on education, to determine as well as possible what EM's education and development role should be, and the extent to which overlap with other efforts is productive or merely redundant.

The Need for Flexibility

EED has determined not to discourage any promising proposals, internal or external, by establishing a narrowly-defined niche for the activities it supports. At this early stage of implementing the EM mission, there is simply too much uncertainty--about exactly what compliance and cleanup will mean and entail between now and the year 2019; about the number and skill mix of people needed to correspond to various possible long-range technology and public policy scenarios; about how much of the manpower education and development mission is strictly DOE's responsibility or forte; and about where EED can intervene to leverage its funds to yield both quick results and to institutionalize programs for the future.

In summary, meeting the needs-driven human resource requirements of a 30-year EM Program necessitates a strategy that--like the overall strategy for Technology Development--is carefully but not rigidly focused on both near-term and long-term problems, and that recognizes the relationships between the two. The key to success lies in helping enhance the science education pipeline and in selectively choosing the most effective intervention points to realize EM's specific needs.

EDUCATION AND DEVELOPMENT PROGRAM STRATEGIC COMPONENTS

The three major components of OTD's education and development program are (1) **Pipeline**: meeting future workforce demand by increasing/enhancing the flow of appropriately trained and educated people from the education pipeline (K-graduate school); (2) **Current Workforce:** training and retraining the current workforce; and (3) **Environmental Literacy**: creating and maintaining an environmentally literate public through outreach and professional societies. Emphasis will be placed on opening up new opportunities for women and minorities to participate in these crucial activities. It must be recognized that in these technical areas, participation by all groups is paramount in assuring that all of society is represented in the process of restoring our environment and establishing the new DOE conscience.

IMPLEMENTING THE EDUCATION AND DEVELOPMENT PROGRAM--ACCOMPLISHMENTS AND PLANS

The three EED strategic program elements--Pipeline, Current Workforce, and Environmental Literacy--are implemented in seven categories: Academic Partnerships, Outreach and Environmental Literacy Activities, National University Interactions (scholarships, fellowships, and

awards), Community College Programs, Continuing Education, and Program Planning and Evaluation

Innovative Academic Partnerships: Flexible, Fast, Regional/National Results

Academic partnerships, designed for practically immediate (three to five years) payoff, are an efficient way to get EM curricula established within a multitude of institutions on a national scale. Academic partnerships provide formal linkages with groups or consortia of universities to meet the educational needs of DOE sites' environmental mission through: faculty development/recruitment; enhancement of inter- and multi-disciplinary educational approaches; student recruitment and career counseling, particularly with minority and educationally disadvantaged students; internships; linkages with middle schools, high schools, two-year academic institutions, and the private sector. Partnerships are designed to become self-supporting after a maximum of five years.

EED has established three pilot academic partnerships. A brief sketch of each follows, including participating institutions, recent accomplishments, and near-term objectives.

Waste-management Education and Research Center (WERC)

This activity establishes a pilot program in the State of New Mexico for an Education and Research Center committed to waste management. The pilot program is established pursuant to a cooperative agreement between the Department of Energy and New Mexico State University (NMSU). NMSU leads a consortium of universities and colleges established for this purpose, consisting of itself, the University of New Mexico, the New Mexico Institute of Mining Technology, and Navajo Community College. WERC also involves the active support and participation of the Department (Albuquerque Operations Office), Los Alamos National Laboratory, and Sandia National Laboratory.

FY 90-91 Accomplishments: A national environmental engineering design contest was held in Las Cruces, New Mexico, on Earth Day; an eleven-program interactive university-level video conference training series is underway; an Associate degree program for radioactive and hazardous materials handling has been established. These activities have involved 100 faculty, 700 precollege students, and 400 college students.

FY 92-93 Objectives: Continue interactive video conference series, reaching over 50 sites in two states on topics of waste minimization and radioactive/mixed waste management; continue national environmental engineering design contest, with second cycle expected to expand up to 30-50 schools nationwide.

South Carolina Universities Research and Educational Foundation (SCUREF)

Under a cooperative agreement with DOE, SCUREF is a consortium of universities including the University of South Carolina, Columbia; Clemson University; the University of South Carolina, Aiken; the Medical University of South Carolina; and South Carolina State College.

FY 90-91 Accomplishments: Established a Distinguished Professor Program at each member institution; created video lessons in beginning algebra for middle and high school students in South Carolina; established 10 separate outreach programs, including earth science for elementary teachers, teacher aid education, math excellence workshop, summer engineering institute, and a mentor program. These activities involved 134 faculty, 86 precollege students, and 213 college students.

FY 92-93 Objectives: Award five additional Distinguished Scientist chairs for environmental management; develop curricula for environmental courses at all member institutions; develop, through member institutions, a coherent K-12 enhancement program in science and math throughout South Carolina.

Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) Hazardous Materials and Waste Management Consortium

The HBCU/MI Consortium is comprised of Alabama A&M University, Clark Atlanta University, Florida A&M University, Florida International University, Hampton University, Howard University, Jackson State University, New Mexico Highlands University, North Carolina A&T State University, Northern Arizona University, Prairie View A&M University, Southern University at Baton Rouge, Texas A&I University, Texas Southern University, Tuskegee University, University of Texas at El Paso, and Xavier University in Louisiana. The focus of the consortium is on pre-college, post-secondary, and undergraduate educational components, and involves curriculum development, student and faculty development, research and development, and outreach activities.

FY 90-91 Accomplishments: Established Environmental Management Career Opportunities for Minorities (EMCOM) Program with all member institutions, including summer research appointment at DOE National Laboratories, with close support structure in the lab and on campus; held curriculum development workshop at Jackson State in July 1991 with over 60 professors from the member schools: focused on enhancements to chemistry and other science courses toward environmental and regulatory concerns resulting in 19 new courses, 10 courses modified, and eight new faculty hired. These activities involved 225 faculty, 1489 precollege students, and 386 college students.

FY 92-93 Objectives: Establish, through the Presidents' Council, environmental specialty areas to be pursued by each HBCU/MI institution; host annual conference of Black/Minority businesses to encourage minority business participation in DOE environmental cleanup activities.

Outreach and Environmental Literacy Activities

The five-year goal of the K-12 Outreach Program is to implement activities that evolve into a "good infection" of the U. S. precollege educational system, winning students' interest, enhancing teachers' knowledge and abilities, and persuading State policy-makers to institutionalize environmental education for all young people, including the minorities and women who are becoming a larger and larger component of the American workforce.

FY 90-91 Accomplishments: Established environmental education precollege programs at each DOE site, affecting about 1,000 teachers and 20,000 students. For example: (1) Students Watching Over Our Planet Earth (SWOOPE), an innovative science program in New Mexico that helps to bring science into the student's own personal setting through the

hands-on approach--using discovery kits, students gather environmental data on radiation, radon, and water quality--and to raise the general level of scientific literacy in the family and community; (2) Environmental Management Precollege Analytical Chemistry (EMPAC), through Idaho, offers university-level summer chemistry courses to motivate high school sophomores and juniors to pursue careers in science and engineering; (3) Science and Technology Education Programs (STEP), through Nevada, supports teacher training to improve proficiency of education professionals through workshops, stipends, courses, and cooperative employment; (4) Environmental Education Outreach for Minorities (EEOM), through Brookhaven National Laboratory, develops a two-term course in the fundamentals of environmental science, and includes teacher training, student recruitment, summer work experience for students at a DOE facility, and the tracking of student educational and career choices.

FY 92-93 Objectives: Continue precollege outreach activities at all DOE sites, with emphasis on dissemination and replication of highly successful projects at other sites; initiate interagency environmental education activities with EPA following participation in the November 1991 national conference; expand SWOOPE throughout New Mexico and near selected EPA facilities as an interagency environmental education effort (projected to reach up to 15,000 students in 1992; issue a non-competitive financial assistance award to The League of Women Voters Education Fund to update the Nuclear Waste Primer and conduct public information seminars (award made).

National University Interactions

Direct financial assistance programs offer perhaps the greatest opportunity to affect the production of graduates with specific science and engineering skills necessary to do the EM job. As more degree and specialty concentration programs are formulated, EED will provide more scholarships and fellowships to enable many students--particularly those in underrepresented groups--to take advantage of these BS programs. Inspired young science and engineering faculty must also be rewarded, to motivate them to keep up their good, necessary work (and to motivate their institutions to grant them tenure).

FY 90-91 Accomplishments: Initiated the second cycle of appointments, for a total of 12 untenured faculty awards, directing education and research towards DOE's environmental challenges; awarded the third cycle of EM fellowships, resulting in a total of 30 graduate students participating in practicum and environmental studies; awarded the second cycle of scholarships, selecting 50 undergraduates from applications received nationwide; completed the first cycle of joint faculty-student research experience in environmental management studies at National Laboratories through the Environmental Management Career Opportunities Research Experience (EMCORE) program.

FY 92-93 Objectives: Continue fellowships, scholarships, and untenured faculty awards with dissemination of results of research assignments and practicums though conferences and newsletters; formalize process to retain students through employment with DOE or National Laboratories; explore opportunities for Integrated Demonstrations as well as international assignments and exchanges for practicums related to environmental management applied research and development.

Community College Programs

DOE education programs in past years have focused primarily on the university level and "best and brightest" initiatives. But the needs-driven focus of the long-term EM program and the pivotal position of these two year institutions in the education pipeline--for AS degrees and as bridges to four-year colleges--combine to place a priority on a multi-dimensional approach to community colleges. The nation's community colleges represent a key transition point for millions of students--particularly women and minority students--between high school and the four-year institutions. Community college activities, involving both EM curriculum development and the establishment of linkages with high schools and four-year institutions, are designed to help these institutions become a national "heartland" for channeling and challenging fresh high school graduates toward technician-level EM careers.

FY 90-91 Accomplishments: Established technician/technologist training at community colleges near DOE facilities (Mesa State College in Colorado, Eastern Idaho Technical College, Columbia Basin College in Washington) for certificate and associate degree programs; developed assessment of 27 Tribal Colleges' capabilities to provide programs for technicians in EM activities; established Resource Instructor Institute to support community college faculty as part of Partnership in Environmental Technology Education, expected as an interagency effort to support technicians for DOE and EPA laboratories in the Southwest.

FY 92-93 Objectives: Formalize linkages with community colleges through partnership arrangements for education and training interactions with DOE facilities through Notice of Program Interest (published October 1991); complete assessment of Tribal Colleges' capabilities for providing technicians and technologists; continue involvement with Resource Instructor Institute, with potential expansion for Department of Defense environmental requirements.

Continuing Education

The purpose of activities within the Continuing Education program is (1) to provide necessary training and enhancement opportunities for current EM workers; (2) to attract new employees and retain existing ones by making DOE an attractive place to work; (3) to provide EM career development opportunities for current employees whose jobs no longer exist upon site mission conversion to EM; and (4) to complete an EM-wide training needs assessment on a priority basis.

Significant resources already exist within the DOE system to address these needs. Each DOE facility has its own training organizations and line management responsible for enhancing the skills of the existing workforce. Mechanisms are also in place for the development of shared training efforts. DOE offices, including EED, sponsor the Training Resources and Data Exchange (TRADE). TRADE is a peer-to-peer network of 1500 contractor training and human resource development personnel. Special interest groups within TRADE include those for Radiation Protection Training, Industrial Hygiene Training, and Environmental Management. EED shares oversight and support responsibilities with other DOE offices for the TRADE Environmental Management Special Interest Groups (EM-SIG). Other TRADE SIGs with resources of value to the EM mission include the Advanced

Technologies SIG, and the Human Resources SIG. These groups provide direct and integrated access to networks of people already committed to the success of EM operations and knowledgeable about training in the DOE context. The challenge for EED is to bring these diverse and largely independent resources into a coherent whole.

FY 90-91 Accomplishments: Created a framework for a structured, systematic training needs assessment; evaluated the suitability of training programs developed through the National Institute of Environmental Health Sciences (NIEHS); created networks with training staff of other DOE offices; co-chaired the Accelerated Training Workgroup of the Federal Facilities Environmental Strategy Executive Committee, a combined EPA/DOE/DoD effort; developed seminars on EPA/RCRA orientation.

FY 92-93 Objectives: Conduct training needs assessment to determine, on a site-specific basis, the additional education required to bring displaced workers into the EM workforce; become the focal point for development and evaluation of interactive distance-learning training and educational technology to meet current and future DOE needs; identify and capitalize on labor union training capabilities.

Program Planning and Evaluation

Without a cogent and ongoing assessment of the current and projected EM demand for manpower, of the supply of such manpower likely to result from various kinds and magnitudes of intervention, and of the ways to attract and retain needed personnel from that supply, EED has either no mission or no assurance of success in implementing it. The existence of EM-50 generally and EED specifically is predicated on a projected shortfall in appropriately trained and educated human resources. In short, manpower mandates the existence of DAS/TD's education and development program.

FY 90-91 Accomplishments: Completed Environmental Education and Development Strategic Program Plan; drafted Implementation Plan and Management Plan to describe roles and responsibilities and approach to accomplish goals and objectives by program elements; initiated Manpower Assessment to determine human resources (number and skill mix) required to meet the EM mission at DOE sites.

FY 92-93 Objectives: Complete first annual Manpower Assessment (report due April 1992); initiate a coordinated effort for objective evaluation of environmental education programs to assure effectiveness, both on their own individual terms and as they contribute overall and in an integrated fashion to accomplishing EED's goals.

Thus, EED has laid a solid foundation for its future efforts and is embarked on a forward-looking path to invest in the human resource assets needed by DOE for the cleanup mission, both now and in the future. The elements of that plan support and reinforce each other as progress in one area provides payoff in another. Outreach, for example, taps interests that can be satisfied in precollege, college, or post-college programs, and ultimately in a career with the Department. The communities, the DOE, and the Nation all win.

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5/7/93