EDUCATION INITIATIVES AND COOPERATIVE ENVIRONMENTAL MANAGEMENT RESEARCH OF THE PILOT DOE/UNIVERSITY PARTNERSHIP IN SOUTH CAROLINA

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ABSTRACT

A pilot DOE/university partnership was started in South Carolina with the signing of an agreement between Westinghouse Savannah River Company and the South Carolina Universities Research and Education Foundation. In this paper, the goals and administration of the partnership are discussed. Education initiatives and cooperative research activities in the areas of environmental restoration and waste management, during the first year of the partnership, are identified and discussed. Early successes are highlighted and suggestions are given to improve the partnership program.

INTRODUCTION

On March 27, 1990, Westinghouse Savannah River Company (WSRC), the operating contractor of Savannah River Operations for the Department of Energy, and the South Carolina Universities and Research Foundation, Inc. (SCUREF) signed a cost sharing research and development agreement. This agreement addresses mutual improvement of technical capabilities in the environmental restoration and waste management fields, education initiatives to upgrade teaching and learning of science and mathematics, and ways to fill the needs for skilled manpower in environmental management in the Department of Energy (DOE) and the Nation. Signing of this agreement culminated a process of discussions, during which the Department of Energy (DOE) *named the* partnership between DOE, WSRC and SCUREF as one of (at the time) two pilot centers for DOE/University Partnerships in the nation.

The objectives of the agreement between SCUREF and WSRC are to develop cooperative research and development in environmental restoration and waste management, to increase the number of engineers, scientists and technicians able to address these issues, and to transfer technology. Implementation of the agreement includes technology transfer activities, a distinguished scientist program, a user facility for demonstration of technologies, an information center, education and training, and cooperative research and development.

During the first year of the partnership, a number of education, research, and technology transfer initiatives were begun. In this paper, these are identified and discussed, along with a overview of how cooperative research is identified, a summary of results of the cooperative effort, some highlights of early successes, and suggestions for improving the partnership program.

SCUREF ADMINISTRATION

SCUREF is a consortium of five universities and colleges in South Carolina. The member institutions are Clemson University, the Medical University of South Carolina, South Carolina State College, the University of South Carolina-Aiken and the University of South Carolina-Columbia.

Administration of SCUREF activities is performed by a chief operating officer (COO), his/her support staff, a fiscal officer, and various advisory groups. The COO reports to a Board of Directors composed of the Presidents of the member institutions. During the first months of the partnership, no permanent, full-time COO was identified;

the position was filled in interim status on a rotational basis by the Vice-Presidents for Research at the member universities.

To ensure orderly implementation of the partnership, a working group (WG) comprised of representatives from each of the SCUREF member institutions began meeting weekly in May, 1990. Activities of the WG include development of SCUREF administrative procedures, action on faculty responses to education and research needs expressed by WSRC, planning and conducting faculty information meetings, fostering collaboration among the various faculties and universities, and communicating to the SCUREF Board of Directors through the interim executive director. WSRC provides resources and a group facilitator for the WG meetings.

THE PROCESS

The process of funding cooperative research and education initiatives begins with a Statement of Need (SON) by WSRC. Chartering itself as the review board for responses to SONs, the WG developed procedures for expediting distribution of SONs and the timely receipt of faculty responses, known as concept discussion papers (CDP). When multiple responses to any SON are received, respondents are urged to communicate and develop, if possible, a collaborative response, and to identify which investigator shall serve as the principal investigator (PI). This approach has been effective in developing either a single response to each SON, or multiple responses, each of which uniquely addresses the stated need and is potentially worthy of funding.

After SCUREF submits the summary response to WSRC, the WSRC technical representative and PI enter a period of discussions to define a scope of work. This results in a request for proposal, to which the PI responds with a formal proposal that includes a work plan, itemized budget and quality assurance (QA) plan. This proposal is evaluated for merit, adherence to the stated scope of work, reasonableness of budget, and proposed QA plan. Successful proposals result in the award of a task order by WSRC to SCUREF on behalf of the PI.

MAJOR INITIATIVES

Technology Transfer

Early in the partnership, a twelve member technology transfer council was formed to facilitate rapid and significant achievement in this area. Membership includes two faculty from each of the SCUREF member institutions and representatives from WSRC and private industry. This council was created to develop and implement activities designed to facilitate the flow of technology between WSRC and private industry.

Council functions include planning and conducting various projects, including creating a technology transfer curriculum, interfacing with small business, and *improving* information transfer.

The technology transfer curriculum being planned will include subjects such as patents, license technology, and technology transfer related legislation. It is envisioned this project, among other things, will train students to assist in the movement of technologies from government laboratories to the private sector, thereby increasing the competitiveness of American industry in the global market.

One of the first activities of the technology transfer council was an innovative summer institute in technology transfer. The goal of the institute was to make an independent assessment of the value of WSRC technology to private industry. The program was conducted at USC-Aiken over a ten week period during the summer of 1990. Fifteen students, from undergraduate programs in business administration, engineering and science, and five faculty members, representing the five SCUREF member institutions, reviewed 133 disclosures from the first year of WSRC operation at the Savannah River Site (SRS). Fifty disclosures were selected and reports on the business opportunities for each disclosure were prepared. Eight visiting lecturers covered topics ranging from creativity to marketing in a weekly seminar series. The program resulted in very successful interaction among the SCUREF member institutions and between SCUREF and WSRC.

Graduate Education

The SRS employs more than 22,000 people of varying educational backgrounds. An identified need is the opportunity of these employees to study toward advanced degrees, particularly in engineering, business administration, and math and science, without extended periods of time away from work. Toward this goal, SCUREF is developing consortium-wide graduate programs of study. A guiding premise is that the SCUREF universities will contribute in a way that maximizes each school's particular strengths.

The design and implementation of this program is to be conducted in four phases. Phase one will consist of data collection, preliminary planning, identifying an on-site coordinator, arranging joint appointments of WSRC personnel as faculty, determining space and other resource requirements, and arranging teleconferencing and video-based instruction.

In phase two, WSRC will evaluate the data collected during the first phase and recommend the range of programs to be implemented at SRS. Phase three will begin the delivery of a limited selection of coursework, and phase four will see full implementation of the program.

Critical issues which must be resolved include transfer of credits among universities and degree granting institution.

Outreach

During the summer of 1990, a five week Science Enrichment Program was sponsored as part of an NCAA sports camp at South Carolina State College. The NCAA camp was a program for limited resource students. One hundred and twenty students, ranging in age from 10 to 16 years, participated.

The science enrichment program had two components: sports science and natural science. Each involved five hands-on experiments that ran for one week. Every day, one sports science experiment and one natural science experiment were conducted in parallel morning and afternoon sessions. The students were grouped by age, in small numbers. Although they were not required to participate, over 100 students attended every experiment.

The experiments were kept simple and were designed to excite the students about science. As an example, one sports experiment involved recovery of respiration and heart rates after a period of strenuous exercise, such as running up a flight of stairs.

To evaluate the effectiveness of this program, the students were asked to complete questionnaires before and after completing the program. The questionnaires were designed to evaluate student attitudes about science. The results indicated most students experienced a positive change in attitude. The most excitement and interest occurred with the younger students; a result that highlights the need to grab a student's attention at an early age, if he or she is to become interested in science.

The success of this program was highlighted in a recent proposal by the NCAA to require similar programs nationwide as part of the summer camps.

Another outreach activity conducted during the summer of 1990 included learning skills workshops at Clemson University and South Carolina State College. The program at Clemson was conducted as part of a six weeks program to prepare entering freshmen for college. Results of a control group indicated those participating in this program performed exceptionally better in freshman math, physics and chemistry.

The two programs cited above will be continued in the future, and new programs are being planned, such as one to train volunteer Savannah River Site (SRS) mentors to work one-on-one with middle school students in nearby communities.

Distinguished Scientists

A significant component of the partnership agreement is the establishment of distinguished scientist programs at Clemson, the Medical University of South Carolina (MUSC) and the University of South Carolina-Columbia (USC-Columbia). These programs are in place and are focusing on disciplines and research relevant to and supportive of the WSRC mission at SRS. A purpose of the program is to attract scientists of national and international stature to participating institutions and SRS, to enhance the quality of science and education in South Carolina, and to provide the best technical expertise available to address waste management and environmental issues at SRS. This program is modelled after a successful program pioneered by the University of Tennessee and ORNL.

The terms of the partnership agreement specify eight scientists are to be hired by the three SCUREF institutions, 3 at Clemson, 3 at USC-Columbia, and 2 at MUSC.

The first scientist is soon to be named at Clemson and USC. Candidates were identified from responses to advertisements in professional magazines, by nomination and by solicitation. The procedures vary slightly among the universities, but in general, a search committee was formed which is responsible for identifying and screening candidates, conducting interviews and making final recommendations. One or more persons from WSRC are involved on each search committee.

Distinguished scientist positions will be tenured, full professorships reporting to a Department Chairman at the hiring SCUREF university and will also carry concurrent appointment as a Distinguished Scientist at the SRS.

Distinguished Scientist appointees will receive salary and research support from each institution (WSRC and the hiring SCUREF university) in proportion to the relative involvement at each institution, which may vary with time, and with respect to his or her capabilities. The participating SCUREF universities will provide graduate students and/or technicians, and suitable laboratory space and office facilities for the appointees' research programs. Space, equipment, support personnel, and supplies will be provided at the SRS for work performed and for time spent at the SRS as agreed upon during the search process.

Each school is expected to have one such professor on the faculty by 1991. It is expected that six such professors will be on the faculties in 1992 and eight such professors by 1993.

Science Saturday

Recognizing too many recent graduates of the pre-college school system are deficient in basic math and science skills, a new program is being instituted to help South

Carolina middle and high schools better prepare the students in these subjects.

The program will begin with a series of meetings designed to ascertain what changes are needed in the South Carolina precollege educational system. These meetings will include high ranking people in South Carolina's educational system, such as the Superintendent of Education, a representative from the Governor's Office, the SCUREF Deans of Education, representatives of area schools, and WSRC and other industries. The goal of these meetings will be to identify which segments of society--such as parents, teachers, and industry--are most affected by the shortcomings in science and math education, and what is their greatest cause of dissatisfaction. An expected outcome of these meetings is that teachers and administrators can create an approach to the identified problems and select projects that address the concerns of these groups.

The program will culminate in a "Science Saturday Conference," an educational summit where outstanding precollege teachers will discuss the proposed projects, choose the best ones, and decide how to implement them.

Scholarship Programs

Three SCUREF scholarship initiatives were designed which will not only increase the number of female and minority scientists and engineers, but will also increase the number and expertise of science and math educators in the less affluent inner city and rural areas of South Carolina. The programs are geared toward educationally disadvantaged women and minorities who come from rural and inner city areas and could not normally afford a college education, but have a high potential for excellence in a field of science, engineering, or technology.

An impetus for this program is that the traditional student pool for scientists and engineers, white males, no longer provides adequate numbers to meet national demands. Therefore, other groups, notably women, blacks and Hispanics, must be added to the pool. These groups will increasingly be called upon to contribute to science and engineering.

The first scholarship initiative will increase the supply of female and minority scientists and engineers. It will provide qualified high school students with tuition and living expenses at a SCUREF member institution, where they will earn a degree in an environmental restoration or waste management field.

The next two scholarship initiatives are designed for both current and future teachers. The first is directed at improving the quality of middle school science and math teaching in areas of South Carolina which lack the resources to recruit highly qualified teachers. This scholarship will help minority and female teachers from these areas obtain masters degrees in science or math education from a SCUREF institution.

The second initiative is designed to increase the supply of qualified secondary school science and math teachers. It will enable female and minority high school students to gain a bachelor's degree in science or math education at a SCUREF member institution.

The funds for these teaching initiatives will be in the form of forgivable loans: one-forth of the loan will be forgiven for every year the teacher stays and teaches science or math in the educationally depressed area after obtaining his or her degree. Teachers who leave the area must repay any unforgiven portion of the loan.

Summer Internship Program

As a complement to the scholarship programs, three programs involving students and teachers in work on-site at SRS are scheduled to begin in the summer of 1991.

The first program was designed for female and minority students interested in science, engineering, or technology careers. The objective is to further the recruitment of females and minorities who have high potential for achievement in science, engineering or technology careers, by providing a meaningful work experience which will influence their career choices.

The second program will allow SCUREF and WSRC to identify, recruit and successfully position individuals from rural and inner city school systems who have a high potential for achievement in math and science teaching. The summer work program is designed to provide the interns with first hand knowledge about work in a technical environment. This knowledge hopefully will be translated into more meaningful classroom instruction and career guidance counseling.

The third program is designed for graduates of the American Chemical Society Summer School of Radiochemistry. The purpose for this program is to attract and recruit individuals with a strong background and interest in environmental restoration and waste management.

Research Seminars and Faculty Information Meetings

Two series of meetings were held at each campus to acquaint the faculties with the content and function of the partnership. These meetings were conducted by the working group with featured speakers from WSRC. Some of the topics which were covered and which most interested the faculty members were the mechanics of the SON and proposal processes, suggestions about how they could inject themselves into the research initiation process, and how to handle collaboration with researchers at another institution. The latter topic is a major point of concern to those faculty who have never been involved in collaborative re-

search, rather their research procurement experience has been one of competitive proposals with only one being funded.

These meetings were considered successful in allaying faculty concerns and in exciting and encouraging them to participate in the various education and research activities.

Another activity designed to foster research has been a series of research seminars to acquaint the faculties with the environmental restoration and waste management programs underway at the SRS. These meeting were planned by the working group and WSRC facilitators, and are held at SRS or at the nearby USC-Aiken campus. Technical persons at WSRC give short presentations of ongoing activities. These are followed by question and answer sessions which allow input from the university faculty members; as such, these seminars frequently result in a positive two-way exchange of information and ideas. Several contacts between WSRC and SCUREF engineers and scientists have occurred at the seminars and have resulted in cooperative research activities.

Some of the topics covered during these seminars include environmental restoration efforts at SRS, the groundwater remediation-horizontal wells project, remediation research using lysimeters, environmental research, biotechnology, toxicology, modeling and simulation, risk assessment, engineering test facility, robotics and automations, waste minimization, expert systems, artificial intelligence and glass technology.

Additional topics are continually identified by the working group, and seminars scheduled at regular intervals. Dates are selected to avoid major conflicts for the greatest number of potential attendees.

Suggestions to Strengthen the Partnership

Several steps have been identified to strengthen the partnership. These include:

- Strengthen the SCUREF education emphasis.
- Develop an aggressive program to involve private industry.
- Capitalize on the potential for associate degree programs at South Carolina technical colleges.
- Refine the administrative mechanism to coordinate with the DOE Office of Technology Development 5-Year Plan.
- Establish relationships with New Mexico and other partnerships.
- Improve public visibility of the partnership.