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PUBLIC OUTREACH EFFORTS OF THE SOUTH TEXAS CHAPTER HEALTH PHYSICS SOCIETY AND TEXAS A&M UNIVERSITY NUCLEAR ENGINEERING DEPARTMENT

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ABSTRACT

In a cooperative effort of the members of the South Texas Chapter of the Heath Physics Society (STC-HPS) and the Texas A&M University Nuclear Engineering Department, great efforts have been made to reach out and provide educational opportunities to members of the general public, school age children, and specifically teachers.

These efforts have taken the form of Science Teacher Workshops (STW), visits to schools all over the state of Texas, public forums, and many other educational arenas. A major motivational factor for these most recent efforts can be directly tied to the attempt of the State of Texas to site a low-level radioactive waste facility near Sierra Blanca in West Texas. When the State of Texas first proposed to site a low level radioactive waste site after the Low-Level Radioactive Waste Policy Act of 1980 was passed, many years of political struggle ensued. Finally, a site at Sierra Blanca in far West Texas was selected for study and characterization for a disposal site for waste generated in the Texas Compact states of Maine, Vermont and Texas. During this process, the outreach to and education of the local public became a paramount issue.

Fear of the unknown has been effectively capitalized on by anti-nuclear groups seeking to shut-down all things radioactive, including the proposed Texas site. It was recognized that many areas of Texas lacked readily available information and facts based in sound science related to radioactive waste. The State of Texas realized that the local public near the proposed site needed more balanced information and real facts surrounding radioactive waste and radioactive materials in general available to them from sources that they felt were reliable. The first public meetings and lectures were held in Sierra Blanca in June 1992, and were organized by members of the state agency charged with developing the site, the Texas Low Level Radioactive Waste Disposal Authority.

These lectures were intended to provide educational opportunities to all members of the local community and provide a public forum for questions and answers concerning the future facility. Guest speakers from universities and research were invited to give these lectures to allow the community to interact with other non-biased experts on various subjects. Some of these lectures were based upon the STW lectures given by the North Carolina Chapter of the Health Physics Society. Over the years, these lectures have evolved into what is now the STCHPS version of Science Teachers Workshops.

During the last 4 years, Texas A&M University's Department of Nuclear Engineering has made a great effort to recruit new students and to educate as many students and teachers as possible on the various uses and importance of nuclear

technology in their everyday lives. These efforts have been highlighted by professors and graduate students visiting a variety of Texas secondary schools. Also, the Nuclear Engineering Department has hosted various workshops and continuing education programs to promote the education of secondary school Science and math teachers about nuclear technology and theory.

INTRODUCTION

Both the Health Physics Society (HPS) and American Nuclear Society (ANS) have dedicated public education programs and have relied on their local chapters to further develop local community outreach programs at the grassroots levels. Providing educational opportunities to the general public has become an extremely important role for these two professional societies in the current social and political environment. These professional societies have also worked with academic institutions both on the secondary and university levels, providing guidelines, lectures and training materials for public outreach and education. This paper is intended to outline and detail the efforts of both the South Texas Chapter of the Health Physics Society (STC-HPS) and the Department of Nuclear Engineering at Texas A&M University (TAMU) in the outreach and education process.

EFFORTS OF THE TAMU DEPARTMENT OF NUCLEAR ENGINEERING

The Department of Nuclear Engineering at TAMU implemented a combined student recruitment and high school visitation program in 1997 to overcome an alarming downward trend in departmental enrollment. Being a new effort, the first step was to identify and target large urban high schools throughout Texas. Initially, the program was limited in scope and by departmental resources; only 17 official visits were made in the first two years (1). However, many interesting and valuable lessons were learned in those early years. It should also be noted that during this period many unofficial visits were made to schools and professional conferences and retreats were held at TAMU and all over the country to further recruitment efforts.

TAMU has also provided an unique arena to reach out to many students at all grade levels of study through a series of annual programs focusing on many aspects of engineering, including nuclear engineering. These events vary in form from Student Engineer's Week to the Society of Women Engineers' weekend retreat at TAMU for interested female students. Another event sponsored by TAMU is Engineering Day at the Mall; during this event Nuclear Engineering faculty and students interact with the members of the general public at an area shopping mall performing simple demonstrations of nuclear technologies. During these annual events, lectures and demonstrations were given for all interested students attending. A Nuclear Engineering booth was also set up to demonstrate some hands-on aspects of nuclear technology as well as provide handouts for interested students. Over the last four years, the TAMU Department of Chemical Engineering has provided a week-long continuing education course for high school chemistry teachers. The TAMU Nuclear Engineering Department took this opportunity to communicate the many aspects of nuclear theory and technology to attending teachers in one four-hour block of time. While the above activities provided

a means to reach out to the student population and some teachers, it was very limited in scope and could only reach the students that showed an interest in nuclear engineering and happened to attend the event.

During the first series of high school visits, it was discovered that there were some shortcomings in lectures covering nuclear technology in high schools, if there were any nuclear-related lectures at all. These problems were documented and reported back to the TAMU Nuclear Engineering Department faculty members. It was at this point that TAMU Nuclear Engineering Department decided to develop some student lectures to address this problem. During further communications with local teachers and parents of students, it was discovered that most science and chemistry teachers felt they were ill prepared to teach the subject of nuclear technologies and uses. These problems were addressed through the use of resources provided by both ANS and HPS as well as lessons plans developed locally by the TAMU Nuclear Engineering Department.

In 2000, the TAMU Nuclear Engineering Department hired a new department head, Dr. Alan Waltar. Dr. Waltar made it a priority to promote public education and outreach and to aggressively reach out to all Texas school systems. The faculty, staff, and students of the TAMU Nuclear Engineering Department were highly encouraged to visit the local area high schools or their old schools, with Department resources committed to this effort. A new staff appointment in the Department was created, the Outreach Coordinator. This new position was charged with recruitment of new high caliber students and creating an outreach program for high schools all over Texas to educate both students and teachers.

In the initial effort during the 2000-2001 school year, some 600 letters were sent to high schools all over the state of Texas. From this mail out, 65 schools made formal requests for visits (2). The TAMU Nuclear Engineering Department sent 13 professors and 2 graduate students to deliver presentations at 35 high schools to a collective audience of 4,735 students and 60 teachers (2). At each of these visits, TAMU Nuclear Engineering Department faculty lectured on nuclear theory and technology and used some simple demonstrations to give the students hands-on instruction. Specialized kits were created so that each of the instructors traveling to give presentations had all the necessary materials for both the lectures and demonstrations. It was also decided to provide each of the high school teachers visited a modified civil defense style survey meter. These meters have a speaker jack added so that a set of computer speakers can be plugged in to more clearly hear the meter clicks. As one can well imagine, it has taken a good deal of resources to restore and modify this era of meter to working condition. Also, Nuclear Engineering Department faculty assisted in professional development sessions done at TAMU by other departments. These professional development classes allowed for the awarding of continuing education credits to attendees.

The TAMU Nuclear Engineering Department has also made efforts to create a useful and informative Departmental website. The main goal of this website is to present Departmental information as well as provide links to other sites for more basic information on nuclear topics, including the HPS and ANS websites. While it is generally recognized that the world-wide-web is a useful educational tool, the importance of personal contact and on-site question and answer sessions cannot be understated.

In the 2001-2002 school year, the schools contacted by the TAMU Nuclear Engineering Department lead to 650 visits and 70 requested lectures (3). The number of

students requesting more information about the TAMU Nuclear Engineering Department and nuclear technologies increased to 1,200. During this period, 42 Texas schools were visited and 6,376 students and teachers attend the lectures given by 22 Departmental personnel (3). In April 2002, TAMU hosted 31 students and 8 teachers from the Beaumont school district for a special workshop that was co-sponsored by the Nuclear Engineering Department and ANS. Upon completion of the lectures, a representative from ANS polled the students for direct and immediate feedback.

While these initial efforts were found to be very successful in reaching both students and teachers, there were a few areas for improvement that were identified. It was found that the system used to contact the schools to offer visits was unreliable and many of the points of contact did not forward the information to the teachers that could have benefited from an in-school lecture. A careful study of the school systems that did and did not respond revealed that some of the largest systems in the state were being left out of the contact system all together.

By the 2002-2003 school year, a new contact system was employed to contact the school systems with a combination of both letters and direct electronic mails. To make more efficient use of time devoted to this effort, some new guidelines were established to ensure that TAMU Nuclear Engineering Department resources were best used to reach out to as many students and teachers in Texas as possible. It was decided to limit the school visits to schools with enrollment of 800 students or greater and to limit the travel time to four hours one-way from TAMU (with the exception of the Amarillo area) (3). Even with these guidelines in place, school systems in areas from Dallas-Fort Worth to San Antonio will be offered visits.

Since these outreach efforts began, 320 different high schools have been contacted and the website has been updated to allow for requests for presentations via the Internet. The website is being expanded to offer student/teacher lecture handouts online. External support for these outreach efforts has been received from the ANS, HPS, and nuclear-related industry. Sources of external funding will be vigorously pursued in the future to promote a partnership between TAMU and industry in these efforts.

The public outreach efforts of the TAMU Nuclear Engineering Department continue to grow in magnitude every year with plans for continued growth into the foreseeable future. Many members of the Department have also assisted the South Texas Chapter of the Health Physics Society (STC-HPS) in their efforts of public outreach in the form of their Science Teacher Workshop Program.

EFFORTS OF THE SOUTH TEXAS CHAPTER OF THE HEALTH PHYSICS SOCIETY

The STC-HPS has been conducting Science Teacher's Workshops (STW) since before 1994. The beginnings of these workshops have been built on information provided by the national organization of HPS and ANS. Early on, the STC-HPS realized that the standard formatted lectures being provided by the national organizations were not specific enough and needed to be updated and modified to fit particular needs and interests of their targeted audience. Not only did this vary by the audience members, but also by location in which they lived. Certain parts of Texas had concerns over particular issues at specific times. In order to best meet the needs of the audience, the lectures were

tailored to suit the unique concerns of each audience. For example, local lectures in the siting area of the proposed waste disposal facility had a focus on radioactive waste. For other locations, safety concerns about nuclear power plants were addressed. The STC-HPS has given 20 dedicated eight-hour STW's in the last four years, with its membership also providing many other types of lectures and talks. Since this outreach program's inception approximately 250 science teachers have directly benefited from attendance at these workshops (4). Directly related to that, some 4,000 students have been instructed using the materials provided at the workshop, with this number growing every year. These efforts have been recognized nationally. Based on the recognition, STC-HPS has been invited to conduct a training seminar at both the 2000 & 2001 national HPS conferences on how to conduct Science Teacher's Workshops. The same presentation was also given to the Canadian Radiation Protection Association at their annual conference in 2001.

A very unique part of the workshop program is that workshops are only conducted upon request. For example, following Sept 11th, public information hearings were conducted in Houston and Bay City, the location of the South Texas Nuclear Project, and lectures were presented on nuclear power plant safety. The full eight-hour workshop can be easily separated into topical lectures tailored to address a particular subject or current concerns.

Many workshops are presented in conjunction with annual meetings of teacher associations, such as the American Association of Physics Teachers and the Science Teachers Association of Texas. The American Association of Physics Teachers has invited the STC-HPS to perform a STW for their last four meetings because the course has been proven to be beneficial to their members. The attendees of this meeting made several future workshop invitations. Not only are teachers being given the tools to help their students better understand nuclear technology, but it is creating a real interest in nuclear applications with both students and teachers. This has lead to a series of invited lectures from members of the STC-HPS as well as the faculty and staff of TAMU at many school systems all over the state. Several members have presented workshops materials as far south as Harlingen on the Texas-Mexico border and into far West Texas in El Paso. No matter where the workshops are presented each local community has some unique concerns that are incorporated into the lecture format and content to target these concerns.

For example, the workshop conducted near the Texas-Mexico border centered on concerns of the local area- possible radioactive and chemical contamination from Texas facilities as well as facilities located in Mexico. The workshop lectures in El Paso focused on nuclear safety and concerns about the irradiators located in the community.

STRUCTURE AND CONTENT OF THE STC-HPS SCIENCE TEACHER WORKSHOP

The typical eight-hour STC-HPS Science Teacher Workshop is conducted in several different sections consisting of lectures, hands-on training demonstrations, operation and use of radiation detector, a question and answer period and a direct feedback session. Each attendee is provided with a complete set of lecture notes, both in a binder and on CD_ROM and a modified radiation detector. A videotape is also

included with two short topics, created at the 7-8th grade level, to inform students about radiation and splitting the atom. Also, several books concerning the future of nuclear power and radioactive waste management are handed out to all the teachers. The CD-Rom contains the five audience-specific lectures directly associated with this workshop, plus three folders worth of handouts and lessons plans provided by ANS. These lessons plans are written for different grade levels as well as the subject type such as chemistry, physics or physical science. Also, laboratory exercises, interactive group activities, and self-paced individual interactive exercises are included on the CD-ROM.

The lectures are broken down into 5 separate topics: Fundamentals of Radiation; Exposure to Radiation in Modern Life Cellular Biology and Radiation Effects; Radioactive Waste Management; and Radiation Safety and Health Physics. Lectures are conducted by a volunteer instructor with experience in that field of study, so that they are best able to answer any questions that arise. Each of the lectures is reviewed and updated to correct any possible errors and to tailor the lectures to the expected audience.

The lecture material handouts and other materials have changed a great deal since this program was first started in 1994. The use of the CD-ROM enables the teachers to return to their classrooms with more reference materials and all the lectures already formatted on using Microsoft PowerPoint software. Another part of the workshop materials gives a complete listing of available government and private websites where more lecture material is available plus reference material for future lectures they wish to create or their students would like access to.

The first series of radiation detectors that were given out to the teachers proved to be very unreliable. STC-HPS decided to find other, more reliable sources of detectors. Many states and the ANS had an ample supply of old civil defense detectors in storage, so the STC-HPS requested to acquire some of them. New sources of meters came with some challenges since the storage conditions varied from usable meters directly from the box to nothing more than rusted parts. A continuing effort with TAMU has led to the restoration and modification of hundreds of these meters so that they could be taken into the classroom and used for lectures.

The STC-HPS workshops incorporate an exit survey coupled with a question and answer session to determine what the teachers liked and disliked most about the workshop. These sessions and surveys provide a direct feedback mechanism. Problems are immediately addressed preventing reoccurrence at the next session. Due to limited resources and reliance on volunteer instructors, the STC-HPS is concentrating their efforts in areas of Texas not covered by other organization, such as the North Texas Chapter of the Health Physics Society. So, now the entire state is covered by organizations that have dedicated time effort and resources to further educate Texas teachers and students.

RESULTS OF THESE OUTREACH EFFORTS

First and foremost, the direct benefit of these efforts has been a remarkable increase in undergraduate enrollment in the Nuclear Engineering Department at TAMU as shown in Table 1 (2).

Table 1. Nuclear Engineering Undergraduate Student Enrollment in 1996-2002

	1996	1997	1998	1999	2000	2001	2002
Freshman	26	28	18	26	28	32	37
Sophomore	17	10	12	26	36	36	49
Junior	16	9	10	18	28	37	50
Senior	15	15	15	19	17	29	45
Total	74	62	55	89	109	134	181

From the data present in Table 1, it is clearly shown that undergraduate enrollment has taken a large increase over the last few years. This can be easily correlated with the efforts detailed in this paper. The TAMU Nuclear Engineering Department currently has limited space available to grow on the campus footprint it currently occupies. There have been some suggestions to a cap placed on undergraduate enrollment. Upcoming changes in scheduling to year-round classes at TAMU is hoped to help mitigate the overgrowth problem. But, this increased undergraduate enrollment has not come without an undue effect on the graduate program. The decreased graduate student enrollment is a cause of great concern at TAMU and has been targeted as a number one priority for 2003.

FUTURE CONSIDERATIONS/WORK

The Science Teacher's Workshop program is an expanding venue for public outreach. The workshops in Texas represent an ongoing effort, with continued steps to improve the quality and content of the materials presented. An effort is currently underway to use Microsoft PowerPoint software technology to add lecture notes to each of the slides being presented. This teaching technique is currently used in academia and has been found to increase the level of information conveyed in each of the lectures.

One recommendation for the program is to put together traveling teams of undergraduate students, graduate students, industry representatives and academic staff. These teams would provide a wide range of perspectives based on their individual experiences. Having this diverse group together for each workshop would enable the workshop attendees to relate to the information on a more personal level.