

# ADVANCED TECHNICAL TRAINING FOR AN INTERNATIONAL AUDIENCE OF PROFESSIONALS, SCIENTISTS AND ENGINEERS: VIDEOCONFERENCE/VIDEOTAPE FROM THE UNIVERSITY OF NEW MEXICO

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## ABSTRACT

Budget cuts and increasing demands for a technically competent work force are problems facing industry and government today. Training requirements must be met in a cost-effective manner. The videoconference format is a proven method that saves money on training and travel costs. The videotapes produced from training programs extend the productivity in any facility.

However, designing a training series that meets the needs of a diverse audience composed of scientists, engineers, and management from government, industry and universities is extremely challenging.

National Environmental Technology Network (NETWORK), a department of University of New Mexico's College of Engineering, has a proven track record in developing and producing effective videoconference training programs for industry, government, national laboratories, and universities. To date, six successful series have been completed: Total Quality Management (two series, one for service organizations and one for manufacturing); Hazardous Waste Management; Waste Minimization and Pollution Prevention; Environmental Risk Management; and Radioactive Waste Management. National awards from the United States Distance Learning and the United States Environmental Protection Agency attest to NETWORK's leadership in providing advanced technical training using distance learning techniques.

This presentation describes how to produce an environmental television series and reveals the keys to successful videoconferencing by describing the past successes of NETWORK's videoconference training and the plans for the up-coming series, Mixed Waste Management. The presentation characterizes how videoconferences can be used as university-developed advanced technical training for shifting the work force from defense projects to environmental remediation and protection. The presentation illustrates how the effectiveness of this training is enhanced by partnerships which evolve between the originating university and the receiving sites. Additionally, the presentation addresses the technical aspects of past series and the Mixed Waste Management series, scheduled to air in April 1994.

## INTRODUCTION

Professionals must continue their education throughout their careers to stay abreast of latest technologies. For example, to keep up with developments in their field, engineers require retraining on an average of every four years. The need varies, depending on the precise discipline. Additionally, many technical professionals currently face significant changes in their careers, as their positions shift from defense-related activities to environmental fields.

With budget cuts and increasing demands for a technically competent work force confronting industry and government today, the emerging training requirements must be met cost-effectively. The videoconference format represents a proven method for communicating the most up-to-date information concerning technical, environmental and management topics. According to Daniel Barron (1), distance education is a means of "...taking quality education to the people who need and want it. Distance education is to instruction what bookmobiles and branch libraries are to reading".

Through this method, thousands of professionals can receive the most current information and participate in training programs simultaneously, via satellite, without incurring the cost of travel and per-diem expenses. The series are structured to stimulate creative interaction and promote a significant exchange of information among technical professionals and stakeholders confronting the increasingly complex environmental challenges of today's world.

Broadcast on C-Band and through NTU, these videoconference series can be received anywhere in the United States. Most organizations already have the equipment necessary for receiving these instructional television broadcasts.

Those not having this capacity can purchase a satellite dish for a minimum investment, a one-time cost for equipment. Videotapes produced from training programs and the accompanying instructional workbooks extend the capacity for training in any facility. Those who participated in the live training sessions have an opportunity to review material and clarify important points. Those who could not attend the live broadcasts can watch the videotapes and complete the training as their schedules permit.

During the live broadcasts, the training experience extends far beyond that of being a viewer. The programs afford every participant the opportunity to interact by means of question/answer sessions throughout each program, via a toll-free phone number or the use of a fax machine. The interaction is amplified by accepting questions before the programs air, throughout the programs, and after the programs are completed.

Designing a training series that meets the needs of a diverse audience composed of scientists, engineers, and management from government, industry and universities, however, is extremely challenging. As Reza Azarmsa (2) explains, "Much like any other area of mediated communication, teleconferencing is both a science and an art". National Environmental Technology Network (NETWORK), a department of the University of New Mexico's College of Engineering, has a proven track record for developing and producing effective videoconference training programs for industry, government, national laboratories, and universities.

NETWORK is part of an environmental consortium funded by the Department of Energy (DOE). The Waste-management Education and Research Consortium (WERC) is composed of New Mexico State University, University of New Mexico, New Mexico Institute of Mining and Technology,

Sandia National Laboratories, Los Alamos National Laboratory and Navajo Community College. Members have teamed together to help solve the environmental problems facing our nation, collaborating in three areas: research, education, and training.

In addition to a variety of videoconference series, six to eight full-credit environmental courses are broadcast from the three member universities on KU-band satellite each semester. WERC also sponsors a summer research lecture series and offers a certification program.

#### **PAST SUCCESSES OF VIDEOCONFERENCE TRAINING AND THE TWO UPCOMING SERIES**

To date, NETWORK has produced six successful videoconference series: Total Quality Management (two series, one for service organizations and one for manufacturing); a 14-part Hazardous Waste Management series, an 8-part Waste Minimization and Pollution Prevention series; a 7-part Environmental Risk Management series; and an 8-part Radioactive Waste Management series.

These live, interactive videoconference series have been broadcast to over 80 sites with diverse audiences. The training has spanned the United States, reaching 8,000 participants in 38 states, 100 industry sites, 64 military/government installations, and 32 universities.

National awards from the United States Distance Learning Association and the United States Environmental Protection Agency attest to NETWORK's leadership in providing advanced technical training using distance learning techniques. These series have received awards for the past three years, and most recently, NETWORK earned an award for "Most Outstanding Distance Education Network" from the United States Distance Learning Association.

Additionally, NETWORK has begun preparations for two new environmental series. A five-part Mixed Waste Management series, to begin broadcasting on April 6, 1994, is currently in production; and a five-part series pertaining to future land use options is in the developmental stage.

#### **HOW TO PRODUCE AN ENVIRONMENTAL TELEVISION SERIES**

To select a topic for a videoconference series, NETWORK surveys DOE sites, requesting information about their current training needs. When sufficient interest is expressed in one particular area, and the funding for production procured, the topic becomes the focus of the next videoconference series.

In the early stages of developing a videoconference, NETWORK conducts an "Environmental Experts" workshop, where environmental professionals meet to listen to speakers and participate in panel discussions and question/answer periods. To facilitate technology transfer, workshop participants complete surveys for NETWORK. These surveys ask the respondents to describe the issues they consider critical for professionals in these fields to address; list the concepts that need to be communicated to stakeholders; identify recognized national experts in the fields; and provide names of periodicals, national organizations and associations important for people involved in this area of expertise.

The next step in the development of a series consists of advisory board meetings, which lay the foundation for the videoconference. National experts involved in previous programs, scientists from the institutions that represent WERC, and stakeholders are all invited to attend. To provide an overview of a series' production, speakers with past experience in

televised training describe the roles and responsibilities of those involved in the process. For example, technical advisors identify program leaders and make sure they are willing to serve in that capacity. The technical advisors must see the broad picture in terms of overall program content and make sure all aspects of appropriate topics are covered. They also work with the NETWORK staff and provide the last line of review for participants' instructional workbooks.

The individual program leaders choose presenters for their program, making a concerted effort to recruit nationally recognized experts in the field. They maintain a balance in the program content and sometimes also serve as presenters.

The program presenters need good speaking skills, for they not only deliver their prepared material, they also interact with the participants at the receive sites during question/answer periods. Presenters are encouraged to incorporate graphics, video clips, humor, and real-life examples to keep their presentations interesting. Each presenter must submit his or her charts, suggested readings, test questions, terms for the glossary, and a brief biography to NETWORK, which subsequently prepares the material in a standard format for the participants' instructional workbooks.

During the next portion of the advisory board meeting, members begin the planning process by developing a proposed series outline. The outline consists of specific program topics, any particular emphasis to be considered for each topic, and possible case studies.

As the topics develop, the technical advisors and the advisory board suggest possible program leaders experts in the field from a wide range of backgrounds in industry, business, and government. NETWORK contacts these individuals, and those who agree to serve in this capacity team with the advisory board and the NETWORK staff to form the nucleus of the evolving series. The program leaders then select five more people with expertise in their program topics to serve as presenters.

Because NETWORK seeks presenters from all over the United States, much of the design of the programs occurs during a series of conference calls. Once the plan has been established for the individual programs, the program leaders meet with the NETWORK staff in Albuquerque to fine tune the content of each program and assure continuity for the series as a whole. This not only reduces the possibility of redundancy, it also confirms that the participants will receive an adequate amount of technical background information. Then, as the scheduled air dates approach, conference calls among those involved in individual programs continue as needed.

Meanwhile, behind the scenes, a graphics artist and technical editor prepare the presenters' material for the instructional workbooks and return the final draft copy to the presenters and the technical advisors for review. The workbooks for each program contain the following information: intended audience, program description, presenters' charts, suggested readings, test questions, presenters' biographies and addresses, a technology transfer questionnaire, an information request form, and a participant evaluation form.

Once developed, the instructional workbooks are sent to each site prior to broadcast of the program. The sites receive two copies of the workbooks, one unbound, for duplication and distribution to all students planning to attend the training, and one bound, to serve as reference material and augment the site's videotapes of the programs.

Simultaneously, the video producer pulls together all the elements necessary for live broadcasts. Scripts are written and case studies for presentation chosen. Arrangements for on-

location productions at the sites are made, then the case studies are shot and edited for the broadcasts. All elements for live broadcast are orchestrated with the studio, down to the selection of soundtrack music.

Prior to the broadcast of the first program of a series, NETWORK conducts a two-hour facilitator training program. Experience has shown that site facilitators contribute to the overall success of this televised training when they function as proactive members of the team. The facilitator training program covers a wide range of instructional material. Facilitators learn technical details, such as how to establish a comfortable environment for the viewers and how to check the operation of the equipment. They also learn how to find the appropriate audience and publicize the upcoming training at their site. They receive tips about effective ways to interact with series advisors and are encouraged to seek experts within the organization who can enhance the learning experience.

In addition to the televised training, facilitators receive a training packet to serve as a reference during the course of the series. Given this overview of what to expect from the distance education experience and how to make it meaningful for the participants, the facilitator often serves as the foundation for the partnership that develops between the university and the receive sites.

One week after the facilitator training program, the first three-hour program is broadcast. Every program within a series contains a minimum of six presenters from industry, government, and universities with varied scientific backgrounds and expertise. Each program devotes one segment to regulations that pertain to the topic of discussion. To increase effectiveness, the live presentations are mixed with video footage that demonstrates the technology involved in the program topic, and relevant case studies that illustrate practical uses of the material. Customized workshops and on-site training are also available.

Publicizing this training event occurs at two levels. NETWORK can assist the sites with publicity by developing a customized brochure, news release and advertisements. A brief promotional tape is also available to the sites. On the broader spectrum, NETWORK notifies former participants of the upcoming series, writes press releases, and develops detailed brochures for distribution. To help ensure a wide array of participants, the NETWORK director publicizes the videoconference training at trade shows and at national meetings on distance education and environmental issues.

### **THE KEYS TO SUCCESSFUL VIDEOCONFERENCING**

The keys to producing effective videoconference series extend into every facet of production. In the preliminary stages, well defined topics and carefully selected presenters with good credibility set the stage. Comprehensive instructional workbooks enable the audience to follow along easily and record their notes. Question/answer periods allow ample time for discussion and encourage interaction facilitate technology transfer and lasting partnerships among the sites.

Regular feedback from the participants following each program enables the production staff to constantly improve on the quality of the series. When a program concludes, participants complete two forms: a Technology Transfer Questionnaire and a Participant Evaluation Form. The facilitator returns these forms to NETWORK, where a thorough review of the evaluations begins. This direct input from the receiving sites allows the technical advisors, program leaders, presenters, and production staff to constantly improve on the quality of the

series capitalizing on what went well, and modifying the programs to make improvements where indicated.

Timing is also an important consideration. Experience shows that short programs, regularly offered, are the most effective. For example, NETWORK broadcasts these live videoconferences at regular intervals, on the second and fourth Wednesdays of each month. And finally, the role of the on-site facilitator cannot be overemphasized. Well prepared facilitators can play a proactive role in distance education, as they bridge the gap between the television studio and the audience and promote an open exchange of ideas and technology transfer.

### **HOW VIDEOCONFERENCES CAN PROVIDE ADVANCED TECHNICAL TRAINING FOR SHIFTING THE WORK FORCE FROM DEFENSE PROJECTS TO ENVIRONMENTAL REMEDIATION AND PROTECTION**

As the work force shifts from defense to environmental careers, large numbers of working professionals need environmental information for current and future jobs. These professionals require immediate, high-level training in specific environmental fields. NETWORK's goal is to assist the Department of Energy's Risk Management Program in complying with Congress's mandate of a 30-year remediation initiative.

Advanced technical training and technology transfer represent a proven method of disseminating valuable information to engineers, scientists, researchers, hospitals, universities, and laboratories around the world. Furthermore, videoconferences provide unique networking opportunities, allowing participants to exchange ideas with recognized environmental experts. During the interactive sections, participants are encouraged to ask specific questions that pertain to their particular site. Throughout the series, audience members begin to develop the tools to change directions in their careers, with a strong emphasis on environmental clean-up and future use of a site.

Transmissions via satellite also offer economic advantages, such as savings on travel and workshop registrations. The price per site allows unlimited attendance during the live broadcasts. To prolong the availability of the information contained in these series, the sites have access to videotapes of the programs and a bound copy of the instructional workbooks for their library.

After each series concludes, participants receive certificates of completion and earn Continuing Education Units (CEUs) through the University of New Mexico.

The Department of Energy currently receives NETWORK's environmental series programs in all DOE Area Offices and facilities across the United States and at DOE Headquarters. This is part of the DOE effort to retrain their workforce from defense to environmental careers and to support environmental technology transfer. Recognition and endorsement are also extended to NETWORK by the American Society of Mechanical Engineers (ASME) and the Hazardous Waste Action Coalition (HWAC).

### **HOW EVOLVING PARTNERSHIPS BETWEEN THE ORIGINATING UNIVERSITY AND THE RECEIVING SITES ENHANCE THE TRAINING**

NETWORK strives to achieve balance and diversity by seeking presenters from industry, government, and universities. Working closely with experts from such varied backgrounds has enabled NETWORK to develop strong partnerships among the presenters as well as the receiving sites.

The ongoing interactive programs promote an atmosphere conducive to mutual awareness and understanding. As a result, unique partnerships can evolve through a distance education

experience. For example, Sandia National Laboratories and Los Alamos National Laboratory subscribed to NETWORK's first series on Total Quality Management in 1990. Both organizations have participated in every series produced subsequently. As a result, a mutually beneficial understanding has developed among the University of New Mexico and both national laboratories. Because individuals feel free to ask site-specific questions, participants throughout the nation come to understand each other better, discovering common ground and seeking common solutions.

#### TECHNICAL ASPECTS OF PAST SERIES AND THE UPCOMING MIXED WASTE MANAGEMENT SERIES

As mentioned earlier, the technical aspects of a videoconference series program content and specific emphasis are determined through the input from viewers of previous series, advisory board meetings, and an Environmental Experts workshop. NETWORK's first two distance education initiatives pertained to Total Quality Management (TQM). A 14-part series offered an engineering/management approach to TQM, and a 6-part series focused on TQM as it applies to service organizations.

The next series, Hazardous Waste Management, consisted of the following 11 programs: Program 1) Introduction: What Is Waste?; 2) Risks Associated with Hazardous & Radioactive Wastes; 3) Transport Processes Related to Wastes; 4) Waste Form Modification; 5) Site Characterization; 6) Sampling and Analysis; 7) Soil and Groundwater Remediation I: Physical/Chemical Processes; 8) Soil and Groundwater Remediation II: Biological Processes; 9) Radiation and Radioactive Materials; 10) Radioactive and Mixed Wastes Management; 11) Waste Minimization and Series Close.

Adhering to the logical progression of the content, NETWORK followed this series with an 8-part Waste Minimization and Pollution Prevention videoconference. The series began with an overview, which defined waste minimization and described the need. Then the training progressed through the following topics: 1) Overview: Why Minimize Waste?; 2) Where Do We Start Waste Minimization?; 3) How Does Recycling/Reuse/Reclamation Make Economic Sense?; 4) Are the Right Product/Process Designs Being Addressed?; 5) Solvents and Organic Chemicals; 6) How to Implement Minimization in Metals, Plating, and Electrical Interconnects; 7) How to Minimize "End of Life" Problems; and 8) Planning and Preparing for the Future.

A 7-part Environmental Risk Management series sought to bridge the gap between technical issues and social concerns. Program titles included 1) Risk: Terminology, Concepts, Methods, Applications and Why Risk Communication Is Difficult; 2) How Do We Decide What Is Risky?; 3) Identifying the Gap: Divergent Technical and Social Methods for Risk Characterization; 4) Quantification of Models for Risk Assessment; 5) Risk Characterization: Synthesis and Communication; 6) Risk Assessment: Communicating Results and Public Perception; and 7) Risk-Based Decision Making: A Final Act?

Concurrently with the Environmental Risk Management series, NETWORK produced an 8-part Radioactive Waste Management series (broadcast on alternating Wednesdays). This series began with 1) An Introduction to Radioactive Waste

Management, and the following programs introduced 2) Interactions Between Radiation and Matter; 3) Decommission and Decontamination; 4) Transportation Issues in Radioactive Waste Management and UMTRA; 5) Low-Level Radioactive Waste Management; 6) High-Level Radioactive Waste; 7) Transuranic Radioactive Waste Management; and 8) New and Other Technologies for Radioactive Waste Management.

Mixed Waste Management, a new series to begin broadcast on April 6, 1994, is currently in production. Generated by government facilities, research laboratories, hospitals and universities, mixed waste is a major concern in remediation projects, including the clean up on the Department of Energy weapons complex and old radioactive waste disposal sites. The mixed waste dilemma will become apparent as the course addresses the most basic questions: "What are the characteristics of mixed waste?" "What are our treatment options?" "How do we store mixed waste?" "Can we dispose of it?" and "What is the citizen's role in the process?"

Among the difficulties encountered is the regulatory framework surrounding mixed waste. The U.S. Nuclear Regulatory Commission (or authorized states) or the Department of Energy regulate the radioactive component, while the Environmental Protection Agency (or authorized states) regulate the hazardous component. The latter regulations, promulgated by the Resource Conservation and Recovery Act (RCRA), are particularly prescriptive and complex. Compliance is also made difficult by differences in accepted waste management practices for the two waste types and by alternative interpretations of regulations.

One approach to the mixed waste dilemma is to eliminate or modify processes that generate mixed waste. Other aspects will require technical and institutional solutions involving all stakeholders in addressing the siting and permitting of mixed waste management facilities. Technical alternatives exist for some mixed waste activities, but resolution of these issues will require a process of risk assessment. Significant public policy/citizens' rights issues exist, especially because of heightened public concern when dealing with risk assessment processes.

Given these problems and others to be identified in this series, it is not surprising that very little treatment and disposal capacity currently exists to deal with the inventory of mixed waste in the country. Significant questions regarding development of a national strategy to address the siting of appropriate treatment and disposal facilities need answers in the near term and must come as a result of consensus building activities involving all stakeholders.

This upcoming training series will offer the following programs: 1) Generation and Characterization of Mixed Waste; 2) Storage of Mixed Waste; 3) Minimization and Treatment of Mixed Waste; 4) Technical Development of Mixed Waste Issues; and 5) Remediation Activities. Participation in this course will facilitate involvement in this process.

#### REFERENCES

1. D. BARRON, "Distance Education: Removing Barriers to Knowledge." *School Library Journal*. November 1989.
2. R. AZARMSA, "Teleconferencing: How to Be a Successful Host." *Tech Trends*. September 1989.