

RESEARCH + EDUCATION = ENVIRONMENTAL DESIGN CONTEST

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ABSTRACT

Waste-management Education & Research Consortium (WERC) has developed an innovative educational experience that has proven to have outstanding benefits for students and contest sponsors. This contest is used by universities and colleges to enhance the education experience by combining elements of engineering with communication, legal requirements and health issues into a final performance. Sponsors of the Design Contest use the contest to augment ongoing research and receive a number of creative and innovative solutions for a given task problem. This paper will detail these benefits.

INTRODUCTION

The WERC Environmental Design Contest has successfully combined education and research in an innovative hands-on program. In the past eight years, the contest has proven to have outstanding benefits for students and contest sponsors. The ninth annual contest is scheduled for April 12 - 15, 1999. Over a four-day period, 300-400 students, government and industrial representatives, and educators from across the United States will gather in Las Cruces, New Mexico, to observe the proposed solutions in an actual bench-scale operations. This experience has proven to be beneficial to all attendees: students, industrial representatives, government representatives, and educational representatives.

BACKGROUND

Waste-management Education & Research Consortium (WERC) was created in 1990 by the U.S. Department of Energy as a partnership between New Mexico State University, the University of New Mexico, and the New Mexico Institute of Mining and Technology in collaboration with Los Alamos National Laboratory and Sandia National Laboratories; the Diné College joined as an affiliate in 1991. WERC's mission is to expand the nation's capability to address issues related to the management of all forms of wastes, via education, technology development, and information transfer.

Currently, there are undergraduate and graduate educational programs throughout the world on environmental management and engineering. However, there has been no vehicle to bring students from various universities together for solutions and discussions of major environmental issues. Consequently, for the ninth year, a unique and innovative environmental design contest for universities throughout the Americas is being conducted by WERC. The design contest is co-sponsored by industrial organizations, DOE, and other government agencies.

The Design Contest began in 1991 with seven schools participating. Since then, the contest has grown seven-fold. In 1998 there were 21 schools represented making up the 32 teams working on four tasks. Fifty-seven teams from 24 different schools (plus ten high school teams) have registered for the 1999 contest.

RESEARCH VALUE

When a company invests in the Environmental Design Contest, they do so with the knowledge that for the average sponsorship of \$50,000, they will receive from 5 to 20 extensively researched solutions that are bench-scale tested. Each solution will include technical viability, a discussion of

the health and legal issues, verified economic feasibility, and a detailed community involvement plan. Each team is provided only enough information on the task to develop a solution. The idea is to encourage new and creative solutions. WERC, in cooperation with each sponsor, develops the information that is provided to the students. The student teams then work on their research for approximately seven months. While developing the information that is given to the participating teams, WERC must consider potential solutions, have continued communication with the site sponsor, and relay information to the participating teams.

By the conclusion of the contest, the sponsoring site will have seen the innovative and creative processes demonstrated in a bench-scale model. They will have heard the oral presentations and receive technical papers of possible solutions. Past sponsors have told WERC that they receive research that is several orders of magnitude greater than their investment.

Site sponsors are extremely satisfied at the conclusion of the contest. They take this information directly to their site for application. Some sponsors have combined several processes for use at their site. On several occasions, the sponsors have used additional funds to support further investigation and research into the proposed solution. This has provided university students the funding for further refinement, summer employment, and an opportunity to work directly with the site.

EDUCATIONAL VALUE

The contest is a unique tool that prepares the team members for addressing challenges they will face upon graduation. The team members practice project management, personnel interactions, conflict resolution, team-work, the importance of interaction with other disciplines, communication, and application of technology to solve realistic problems.

Each team must prepare:

- I. A written report including: the process design and a detailed total plant design, the engineering and economics of the process, a discussion of the legal and health implications, and a plan for presentation to the community for public acceptance so that problems are minimized after construction;
- II. A practical bench-scale working model of the process to demonstrate functionality of the process;
- III. A brief oral presentation of the design including economics, health, business development, regulatory, and other related issues; and
- IV. A poster presentation containing highlights of their design.

The educational benefits are similar to building a house. The foundation must be sound. All of the fundamental elements that are taught in engineering must be understood and are the basis on which to build. The house plans must be drawn and redrawn to fit the needs of the owner. Solution options must be considered from several viewpoints: viability, cost, completeness, and user-friendliness. Each university builds their team, based on the disciplines required to effectively address the environmental challenge. Inter-disciplinary teams are recommended and tend to produce the best results. The participating team works together while formulating the solution plan. Generally, the team size has an impact on the number of solutions that are considered. Each solution must be researched and the most viable solution selected for the direction of their research.

Once the foundation is laid and the overall direction is decided, preliminary work begins. After parts are ordered and assembled, construction begins. Construction criteria must be met at all phases and guidelines strictly enforced. For construction such as this, consideration must include all guidelines for EPA, DOD, and DOT. Everything is assembled according to "code". Their selected process is tested many times before the final product is complete.

Not only must the team build their process, they must provide a written report that includes all of the phases. The report must be not only technically accurate but grammatically correct. These written reports are read by the judges prior to the contest and are the first impression of the team and their process. The team then makes an oral presentation to the judges. Following the oral presentation, the judges question the team concerning their processes. Since the judges represent a variety of government agencies, academia, and industry, their questions are focused in their own areas of expertise. The judges assure themselves that the team is accountable for all of their processes and understand completely their responsibilities toward the entire process.

According to the participating students, they learn more from competing in this contest than they have ever received in a single class. These students will make employees that are up to date on current methods, can work as a team, and complete an assignment in a timely manner within monetary guidelines.

CONTEST JUDGING

Contest judging is performed by experts from academia, government, and industry. The judging is based on technical, as well as other criteria such as economics, risk analysis, health regulations, public policy and communication. Each of these criteria is crucial for project implementation in today's world.

The following is a partial list of agencies, industries and academic institutions that have been represented by judges: AFCEE, INEEL, Los Alamos National Laboratory, Sandia National Laboratories, Oakridge National Lab, State of New Mexico, US EPA, US DOE, US Dept. of the Interior, White Sands Missile Range, EG&G, Fluor Daniel, Beta Corporation, GeoSyntec, Allied Signal, SM Stoller, Waste Management Federal Services, Westinghouse, SAIC, Ch2M Hill, WPI, PNL, Rust Federal Services, Roy F. Weston, Colorado School of Mines, New Mexico Tech, Univ. TX - El Paso, Univ. of MO, and Xavier Univ.

Since the judges for the contest represent a large variety of backgrounds, WERC is assured of balanced and equitable judging from many different perspectives. The judges spend long hours evaluating the presentations at the contest, as well as many hours prior to the contest, reading and evaluating the papers prior to arriving in Las Cruces. During the competition, the judges' twelve-hour day includes attending oral presentations, evaluating bench-scale and poster presentations, and final discussions that are completed by approximately 9:00 PM each evening. Their greatest reward comes from interaction with the participating students from across the United States (and beyond) and is considered to be a "natural high" for every judge.

BRIGHT FUTURE

Upon completion of the aforementioned house, others view the house and note that great attention was paid to all details. They, in turn, will decide their house should have the same value and quality as they have seen in this house. This holds very true for the participating students. The senior-level individuals who make up the judging teams are very aware of the quality of what they are seeing first-hand. The judges make their own notes of the players involved. Many of the students will find that a number of employment opportunities arise from their participation. Several judges from industry attend with the intention of hiring the brightest students from across the United States. One particular company, located in California, has hired one or two students every year for the past four years. That company contends that the students who compete in the contest are simply better employees.

The judges representing government organizations also realize the excellence they are seeing and often keep in touch with certain students. From the academic sector, some of the judges have recruited post-graduate students who have an interest in furthering their education in areas of expertise offered by a particular institution. Everyone benefits! There is no down-side to this program.

For the past several years, WERC has sponsored a Job Fair that is held the morning prior to the final awards banquet. There is no booth fee involved and the job fair participants are invited to attend the final banquet.

One of the main differences between our Job Fair and most other Job Fairs, is that the students represent schools from across the nation. They are top students or they wouldn't be here! This is an excellent opportunity for employers!

NETWORKING

One other benefit should be addressed at this time. That is the "networking" benefit. This networking affects not only the students but the judges as well. Consider this: students networking with their own team members; students networking with other team members; judges networking with other judges; and judges networking with the students. All participants communicate during the contest. Titles, status, tenure, hierarchy, etc, doesn't interfere with the networking. Wonderful communication exists between all of the participants - no matter what level.

9th ANNUAL ENVIRONMENTAL DESIGN CONTEST - TASK STATEMENTS

This year's contest will be held from April 12 - 15 in Las Cruces, New Mexico. The following is a list of tasks that will be addressed for this contest.

Mine Tailing Stabilization

Develop and demonstrate the remediation of a large tailings pile which is contaminating ground water and surface water with cadmium, copper, lead, arsenic, and zinc. The design must consider leaving the tailings in place in order to preserve the look of a historical mining district.

Suppression and Immobilization of Radioactive airborne particulates

Develop and demonstrate a suppression and immobilization process for particulates in plutonium contaminated gloveboxes. The process is to be demonstrated on 8"X8" stainless steel plates. A surrogate will be used to simulate the radioactive particulate contamination.

Innovative landfill closure cap

Develop an innovative cap system for solid waste landfills to meet the regulatory permeability standards for 30 years. The full-scale design is to be modeled and verified using a bench-scale demonstration.

Transuranic waste reduction

Develop and demonstrate a decontamination/destruction process to economically reduce TRU (transuranic) waste. The process must be demonstrated on a variety of contaminated items (i.e. cheesecloth, rubber gloves, vinyl tape, etc). Non-radioactive surrogates will be used to simulate the contaminant.

Pipeline waste removal

Develop and demonstrate a process for removal of a gelated plug in a waste pipeline. The process could use chemical or other physical techniques (i.e. pressure/temperature variation, ultra-sonic vibration, etc.). However, avoid using removal tools such as roto-rooter. The process will be demonstrated using a twenty-foot, 1 ½" - 2" pipe, with open ends.

In-situ soil decontamination

Develop and demonstrate in-situ soil remediation (preferably bio-remediation) of High Explosive (HE) and Research Development Explosive (RDX) in tight clay soils. The process must be demonstrated using soil samples packed into test cylinders which simulate natural permeability and porosity.

1999 ENVIRONMENTAL DESIGN CONTEST PARTICIPATING SCHOOLS

Case Western Reserve	New Mexico Tech North	Univ. of Arkansas
Clarkson University	Carolina St. Univ. Ohio	Univ. of California/Riverside
Cleveland State Univ.	Univ.	Univ. of Idaho
Louisiana State Univ.	Oregon State Univ. Purdue	Univ. of Missouri/Columbia
Mesa State College	Univ.	Univ. of Nevada/Reno
Michigan State Univ.	Tufts Univ.	Univ. of Oklahoma
Montana Tech	United Arab Emir. Univ.	Univ. of Pennsylvania
New Mexico State Univ.	Univ. de las Americas	West Virginia Univ.

Additionally, there will be ten high school teams: six from New Mexico and four from outside the state. This year, the Second Annual High School Design Contest, the teams will work only on task 3 as listed above. Their task has been modified slightly and there is no modeling involved.

ACKNOWLEDGMENTS

From 1991 to 1999, the WERC Design Contest has been, gratefully, sponsored by many organizations and agencies. We would like to take this opportunity to express our sincere gratitude to our sponsors for the many years of support, providing both manpower and monetary support.

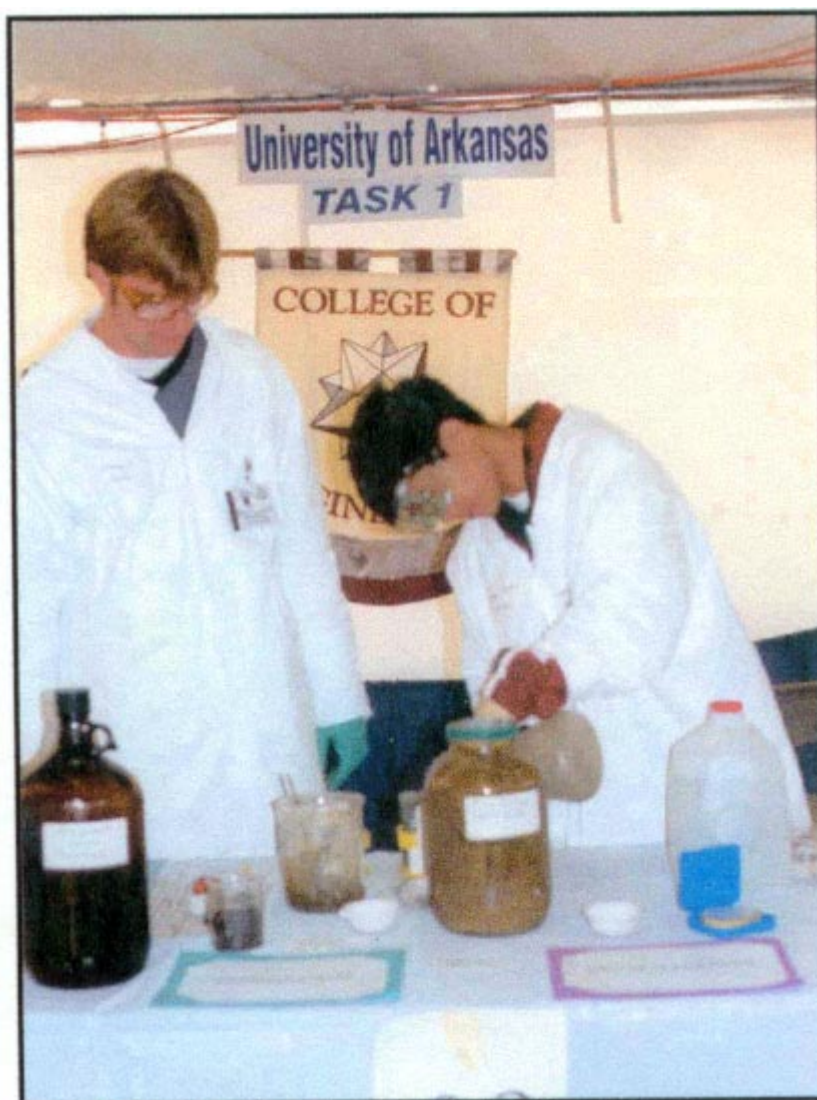


Fig. 1. University of Arkansas.

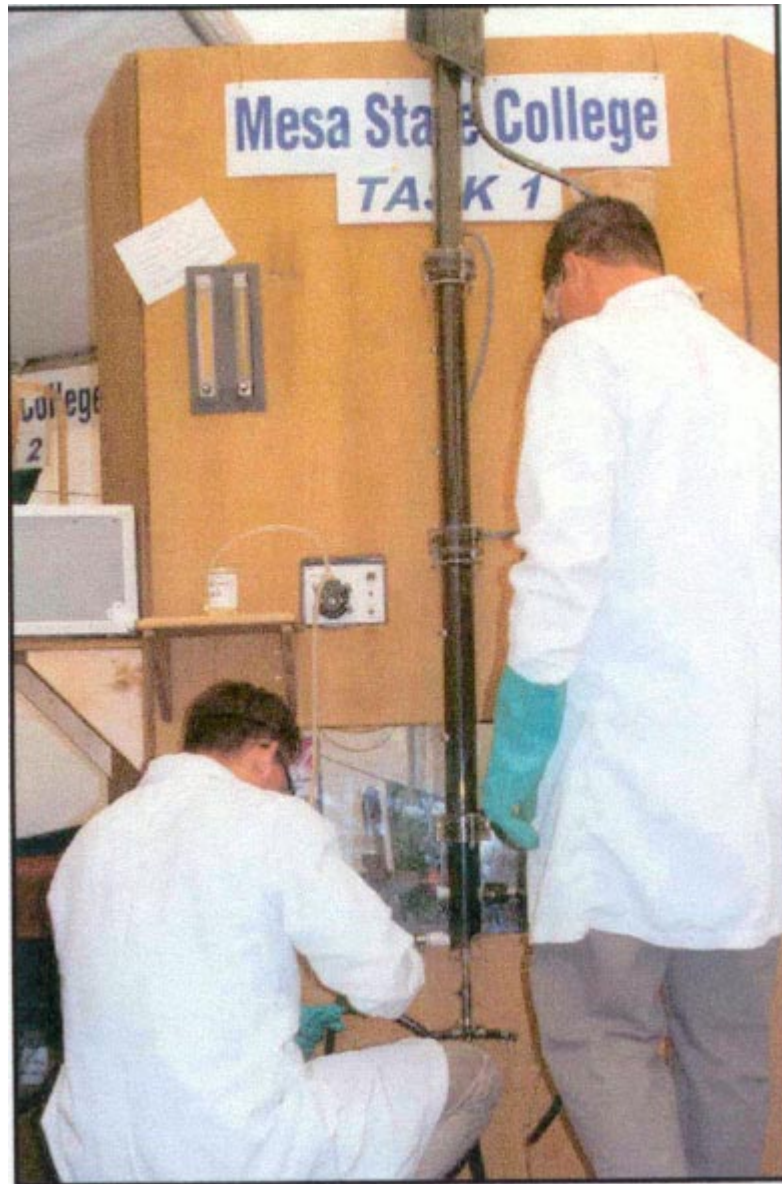


Fig. 2. Mesa State College.



Fig. 3. University of Idaho.



Fig. 4. Montana Tech (and overall winner).