

**WM'00 Conference, February 27 – March 2, 2000, Tucson, AZ**

**INTERNATIONAL ENVIRONMENTAL DESIGN CONTEST  
AN EDUCATIONAL EXPERIENCE**

By:  
Abbas Ghassemi, Executive Director  
Kay Perkins, Asst. to Director  
New Mexico State University  
WERC  
PO Box 30001, MSC WERC  
Las Cruces, NM 88003

**ABSTRACT**

2000 will be the 10<sup>th</sup> Anniversary celebration of the International Environmental Design Contest sponsored by WERC. The Design Contest uniquely combines education and research in a competition that produces results which can be, and are, applied throughout government and private facilities across the United States.

The emphasis for the Design Contest is two-fold:

➤ Research:

Government agencies and private industry provide “real-world” problems to be addressed as a “task” for the Contest each year. The tasks are designed specifically for creativity. The sponsoring sites receive 5 to 10 innovative and bench-tested solutions.

➤ Education:

Many universities use the Contest as a capstone design class and give students 2-4 credit hours for participation. The competition utilizes all aspects that have been learned over the student's educational courses. The competition requires teamwork, inter-disciplinary coordination, research, writing skills, and long hours. The team members remark that the Contest is the single, most educational tool that they experience in college.

The participants in the Design Contest develop a full-scale design while testing a bench-scale working model of their proposed solutions. They consider alternative solutions to a given “environmental challenge” from all aspects including technical, legal, health, socioeconomic and community related issues. The judging criteria includes: process feasibility and practicality, cost analysis, community relations and outreach, adherence to various applicable regulations and permitting, safety considerations, and a discussion of potential waste streams.

This paper will cover the tasks for the 2000 competition and will also cover the results from the 1999 competition.

**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.

## **WM'00 Conference, February 27 – March 2, 2000, Tucson, AZ**

The 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.

For the 10<sup>th</sup> year, WERC has sponsored and conducted a unique contest for students to address environmental issues. The International Environmental Design Contest has significantly increased the educational experience for thousands of participating students. The uniqueness stems from the fact that the student teams must use all of their classes thus far in their educational career in order to complete the given tasks. The students must use reasoning, deduction, writing, research skills, creativeness, and networking.

### **RESEARCH**

Student teams from across the country review a wide variety of tasks for the upcoming competition. The tasks are provided to WERC from the sponsoring sites. Dr. Abbas Ghassemi, the Executive Director of WERC, works closely with the site sponsors to develop a problem statement that will give them the desired creative and innovative results. There are several factors for the teams to consider to help with their decision on which task to compete. Of consideration is:

- Class member interest and the disciplines in which they are involved.
- Which tasks require expertise from the disciplines present in your team.
- Which tasks would the faculty advisor be able to provide assistance.
- Discussions and decision making on research results to determine the best possible solution for the selected task.

### **EDUCATION**

- Students must take a written problem, consider alternative solutions.
- Students must then decide which of their alternative solutions are most practical by thoroughly researching and testing their options.
- In order to complete the entire "picture" the following areas must be addressed in their final product: all applicable health and safety regulations, all laboratory work outlined, community relations plan, and tribal involvement (if applicable).
- The team must build a working bench-scale model which will be judged.
- Each must have 3 different presentations: a written paper presentation, a formal oral presentation, and a poster presentation.

The learning continues at the Contest with interaction between student teams and the Contest judges.

### **DESIGN CONTEST JUDGES**

WERC attempts to have 10 - 15 judges participating in each task. Each panel of judges consist of representatives from the following: site sponsors, EPA, DOE, and task specific industry. Each judge uses their expertise to evaluate their task. There are many factors automatically built into the judging system. The criteria basically consists of thoroughness of research, quality of the written paper, quality of models and effectiveness of the final product. The judges put in 10 hour days to complete their "judging". They meet in the evening to discuss the scores for the day and generally discuss the task progress.

One of the main "perks" for being a judge is seeing tomorrow's employees in action. More than 2000 students have participated in the Contest and many students are offered jobs as a direct result of their participation in the Design Contest. There is no age or student classification for the Contest and each year we hear from at least a half dozen companies that have offered jobs to the eligible students (seniors or

## WM'00 Conference, February 27 – March 2, 2000, Tucson, AZ

graduate students). What an opportunity - this is much better than a job interview! Actions speak louder than words!

### DESIGN CONTEST 2000: TASKS

- Task 1:** Develop and demonstrate a remotely operated station that holds/supports and moves gloveboxes undergoing size-reduction inside a “hard-walled” containment structure.
- Task 2:** Develop and demonstrate a method of identification of buried objects (tanks, lines, etc.).
- Task 3:** Develop and demonstrate a method of unplugging a pipeline.
- Task 4:** Develop and demonstrate an economical method of disposing of or recycling of waste material resulting from the jewelry manufacturing businesses in New Mexico.
- Task 5:** Design and demonstrate a logging tool that accurately and precisely measures the in-situ moisture content of the host rock.
- Task 6:** A. Develop and demonstrate a method by which fresh produce entering the US can be tested to determine if it has been contaminated on the surface with untreated human waste.  
B. Develop and demonstrate a process to determine if sewage sludge used in a foreign country has been adequately treated to eliminate pathogenic microorganisms.
- Task 7:** Develop and demonstrate a reusable crucible that will reduce the generation of TRU waste, while also reducing total worker radiation exposure received during electrorefining operations.
- Task 8:** Develop and demonstrate the recovery of metals for sale and water for irrigation from an abandoned open pit that is part of a historic metal mining district
- HS Task:** Identify the process and demonstrate the disposal of ceramic crucibles which are plutonium contaminated.

### 1999 DESIGN CONTEST FINAL RESULTS

**TASK 1: Mine Tailing Stabilization** Develop and demonstrate the remediation of a large tailings pile which is contaminating ground and surface water with cadmium, copper, lead, arsenic, and zinc. The design must consider leaving the tailings in place to preserve the look of a historical mining district.

**First place: Clarkson University**

**Second place: New Mexico Tech**

**Outstanding Paper: Clarkson University**

**Outstanding Oral Presentation: Montana Tech**

**Outstanding Bench Presentation: Oregon State**

**TASK 2: 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" X 8" stainless steel plates. A surrogate will be used to simulate the radioactive particulate contamination.

**WM'00 Conference, February 27 – March 2, 2000, Tucson, AZ**

**First Place: University of Idaho**  
**Second Place: New Mexico Tech**

**TASK 3: 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.

**First Place: University of Missouri**  
**Second Place: New Mexico Tech**  
**Outstanding Bench Presentation: United Arab Emirate University**  
**Outstanding Approach: Louisiana State**

**TASK 4: 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.

**First Place: Tie: Purdue University and Oregon State University**

**TASK 5: Pipeline waste removal** Develop and demonstrate a process for removal of a gelled 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.

**First Place: Montana Tech**  
**Second Place: Purdue University**  
**Outstanding Oral Presentation: University of Idaho**  
**Outstanding Approach: Tie: University of Nevada-Reno and Cleveland State**

**TASK 6: 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.

**First Place: Tie: Purdue University and Case Western Reserve**  
**Second Place: University of Nevada-Reno**  
**Outstanding Poster Presentation: Michigan State University**

**Outstanding International Presentation: United Arab Emirate University**  
**OVERALL WINNER: PURDUE UNIVERSITY**

**CONCLUSIONS**

In an effort to address the myriad of environmental problems that need to have innovative and creative solutions, WERC has combined an unparalleled educational experience with the research funding available from sites. The result - affordable research funding and preparation of today's students for their graduation and entry to the job market. Many companies have stated that when a student completes the Design Contest, the student, as a employee in their organization, will be able to complete any task given to them.