TEAM MANUAL

Your one-stop source for:

- WERC policies
- Specifications, requirements, and judging rubrics for:
  - Written report
  - Oral presentation
  - Bench-scale demonstration
  - Poster presentation
  - Preparing and submitting the ESP
  - Flash Talks
- Helpful hints for a successful contest experience.
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PART I: POLICIES AND PROCEDURES

Contest Structure

Scoring for the Contest is in four stages:
1. A written report
2. An oral presentation
3. A bench-scale process demonstration
4. A poster board presentation

Contest Philosophy: The stages are modeled after an engineering project proposal.

The WERC Environmental Design Contest simulates the problem-solving process that an engineer might encounter on the job. It follows the format that companies often use to solicit new engineering designs: The Request for Proposal (RFP).

The Format of RFPs vary from company to company; we have selected the facets of RFPs that will challenge college teams and provide effective ways for them to learn about the engineering design process. Each step in the WERC Environmental Design Contest is modeled after the RFP format in these ways:

1. Task Problem Statement: A task statement is published, soliciting engineering solutions to a problem. (In the Design Contest, WERC publishes Task Problem Statements for teams to select. WERC also allows teams to design their own challenge through the Open Task.)

2. Written Report: Competing engineering teams submit a written report discussing their proposed solution, expected performance, test data to show efficacy of the solution, data on expected costs, environmental and waste issues, safety and health issues, plans for gaining public acceptance of the solution, a full-scale implementation schedule, and audits from professionals. (In the Design Contest, teams submit a written report prior to coming to the contest.)

3. Oral Presentation: From the pool of written proposals, selected applicants are asked to orally present their proposed solution to a technical review committee to address questions arising from review of the paper. (In the Design Contest, all teams are invited to orally present their solution.)

4. Bench-scale Demonstration: The technical review committee often pays for a pilot-scale system to conduct a treatability study on actual material to confirm that the planned system works on a smaller scale. (In the Design Contest, teams bring their bench-scale models to the contest for testing.)

5. Poster Presentation: The poster presentation is important in scholarly reporting of engineering solutions. It allows the engineer to quickly refer to the most important facts, illustrations, and conclusions. (In the Design Contest, the poster will be an important part of the discussion with the judges during the bench-scale demonstration.)

6. Cash Awards: If the team is successful in all of the above, they win the contract.

Note that the contest is not a science fair: We require a working bench-scale demonstration that is tested in our own independent labs. We also require a plan for full-scale implementation that considers cost, waste, schedule, feasibility, public acceptance, etc.

Flash Talk Competition

The Flash Talk Competition is an additional, and separately scored, part of the contest.

Judges for the Flash Talk Competition act independently from those who judge the 4-stage main competition (described above). Cash awards for the Flash Talk Competition are awarded independently. To learn more about the Flash Talk Competition, click here.
Contest Orientation

1. **One-hour Video Conference** helps first-time teams understand what judges are looking for: https://www.youtube.com/watch?v=_lInYq9o8H4

2. **werc@nmsu.edu** or **gscarbro@nmsu.edu**: Our email addresses. Please contact us if you have questions.

3. **wercedesigncontest.nmsu.edu**: Our website. Here, find FAQs, published tasks, and general information.

4. **werc.nmsu.edu**: The team management site. It is your connection to the contest for:
   a. Registration and payment via credit card (note that Shopcart adds a 2.5% convenience fee)
   b. Report submissions (Preliminary Plan, Test Plan, ESP, Written Report)
   c. Surveys (What did you like? How can we improve?)
   d. Scores and judges’ comments (find your scoring results after the contest)

5. **Specified Task vs the Open Task**. The five specified tasks are designed by engineering professionals to meet an immediate environmental need. Teams that choose to identify their own topic compete in the Open Task; they are responsible for setting all parameters for their solution.

6. The projects are student-run—entirely organized, designed, and built by students, with faculty serving as mentors for the teams. When teams have questions about tasks designed by WERC, the student Team Leader should contact us directly through “Contact Us” or at the email addresses listed above. The faculty advisors are expected to take a “hands-off” approach, but teams are welcome to consult advisors as they develop their solutions.

7. **Teams usually start their research in the Fall semester** and build their bench-scale models in early Spring. This schedule helps teams make sure they are able to tackle the project and identify team members who are dependable. But some successful teams wait until Spring to begin the project.

8. **Timeline**
   a. Before arrival at the contest, teams prepare:
      i. A fully researched written report. This is submitted 2 weeks prior to the April contest.
      ii. An oral presentation, a conference-style poster, and a fully functioning bench-scale model of their proposed solution.
   b. At the contest, teams:
      i. Give an oral presentation to environmental professionals (the judges).
      ii. Demonstrate to the judges their working bench-scale model. The Task Problem Statement will describe in detail how the bench-scale models will be analytically tested in Las Cruces.
      iii. Mount their poster on a display board (provided by WERC) in the bench-scale area. They refer to the poster while speaking to judges about their bench-scale apparatus.

9. **Deadlines at a Glance** (check the schedule online for specific dates):
   a. **January: Preliminary Plan**. Required only for select tasks. The Preliminary Plan helps teams by ensuring that they are heading on a path to success. They will receive feedback from technical experts if changes are needed. If required, the plan will be described in the Task Statement.
   b. **February: Test Plan**. The Test Plan is required only from teams entering the Open Task. The Test Plan helps WERC prepare to test your bench-scale demonstration.
   c. **Early March: ESP (Experimental Safety Plan)**. Required of ALL participants. The ESP is a multi-step process: ALL steps must be completed prior to the March deadline. Our Safety Officer will guide your team through the safety protocols and benchmarks in the ESP.
   d. **Late March: Written Report**. Required of ALL participants. The written report is a major component of the competition judging. Specifications given in PART I of this manual.
   e. **April**: Come to the contest and enjoy showcasing your work!
10. Registration:
   a. Registration opens in early November and is handled online through the werc.nmsu.edu portal.
   b. A faculty advisor registers the teams.
   c. There is a registration fee per team (includes one Faculty member and up to 5 students per team). Additional team members require an additional fee to help us cover our costs. The registration fee covers less than 1/4 of our costs, but it helps us out tremendously.
   d. Early-registration discounts and multiple-team discounts are available.

11. Judging:
   a. Teams are judged by experienced engineering professionals who ask tough questions, but also encourage teams. They treat the teams as peers and introduce teams to new ideas and approaches. Judges say they appreciate teams’ innovations and forward thinking.
   b. The same judges (usually a team of 4-6 judges) evaluate all stages of the contest for a given team, and the judges evaluate multiple teams within a given task.
   c. A minimum of four judges grade each written report before the team arrives at the contest. Scores are tabulated on the WERC team management site.
   d. On Monday, judges listen to the 15-minute oral presentations and are given 10 minutes after the presentation to ask questions. Judges will not interrupt the presentation. After all presentations for the same task are complete, judges apply final scoring to the oral presentations.
   e. On Tuesday, judges visit the bench-scale presentations in groups of 2-3 judges at a time. Since there are 4-6 judges per task, a team will be visited 2-3 times by different sets of judges. At the bench scale demonstration, teams have the chance to show their model to the judges and discuss parts of the apparatus, their reasons behind each aspect of the design, etc. Judges take the time to discuss the team’s poster and delve more deeply into each team’s design. Students often comment that this is their favorite part of the competition because they feel they are treated as peers by the judges, instead of being “judged.”
   f. On Wednesday morning, while the teams are out exploring* the Las Cruces area, judges convene to determine the awards in each category (see Part I for award information).

12. Team logistics
   1. Teams provide their own transportation to/from the event, as well as their own lodging. On our website, we list hotels that are providing room-block discounts. Please consider those hotels, as they help sponsor the event.
   2. Some teams bring their bench-scale models with them, others ship them to us about one week prior to the contest. Whichever way you bring your equipment, develop a Parts Checklist to ensure that all parts are delivered to the contest. Use caution not to transport hazardous chemicals. We will have the test solutions/testing equipment ready for you in Las Cruces.
   3. After check-in on the first day of the contest, we hold a very nice welcome dinner. Afterwards, all teams must attend the orientation meeting to discuss safety protocols.

13. Order of events:
   a. Day 1: Check-in, Welcome dinner, Orientation, Safety meeting, Bench-scale setup
   b. Day 2: Oral presentations, bench-scale testing by WERC staff
   c. Day 3: Bench-scale testing by WERC staff and poster presentations
   d. Day 4: Morning: Teams are free to explore the area* while judges tally scores.
      Evening: Awards Banquet and Ceremony.

*Nearby sites you may want to see on your morning off: White Sands National Monument, Organ Mountains, Prehistoric Trackways, A Mountain, and many others. (see website)
Intellectual Property
Our task problem statements require novel solutions to current environmental issues. This means that your team will be designing new solutions to problems that sponsors pose. We want to protect your intellectual property while allowing the task sponsors to further explore your team's ideas after the contest.

The WERC Environmental Design Contest Intellectual Property Policy:
1. The intellectual property produced as a result of participation in the WERC Environmental Design Contest:
   a. belongs to the team, its members, and/or its institution, according to the team’s institutional policies.
   b. may be used without charge by NMSU and WERC task sponsors for their specific purposes.
2. Publication rights for the written report, or any publication that results from the report, belong to the team and/or its institution, according to the team’s institutional policies.
3. In cases where the intellectual property is used for commercial applications, the benefits and any potential income will belong to the contestant college or university, according to the team’s institutional policies.
4. Any IP previously established and used in the contest will remain the IP of the original owner.
5. NMSU/WERC does not warrant that any IP produced as a result of participation in the WERC contest would not violate any intellectual property rights owned by other parties.

Awards
Each year, WERC and its sponsors award more than $30,000 in cash prizes. Successful completion of every stage of the design project qualifies teams for the following awards.

2. Task awards (First Place $2500, Second Place $1000, Third Place $500; minimum amounts).
3. Freeport-McMoRan Innovation in Sustainability Award ($2500)
4. The Flash Talk Award (First Place: $1000, Second Place $750, Third Place $500, Audience Favorite $250). Students present an Elevator Pitch accompanied by PowerPoint Slides; The talk is geared toward the general public. (Helps meet ABET Student Outcome #3)
5. WERC Resources Center Pollution Prevention/Energy Efficiency Award ($500)
6. Judges’ Choice Award ($500)
7. Peer Award ($250) (Teams vote on their favorite designs).
8. Terry McManus Outstanding Student Award. (Minimum: $500, according to funding). Faculty nominate a student from their team. See our website for more details.

Award amounts listed above are minimum amounts and may increase with available funding.

See Award Selection Criteria for information on the selection criteria for each award.
Manuscript Preparation

• Page limit: 26 pages.

• Type specifications:
  Font: Times, Times New Roman, or TMS Roman (or similar serif type).
  Size: 12 point
  Major Headings: 12 points, Bold
  Title: 14 points, Bold

• Margins:
  Cover page (Title page):
    2” Top margin.
    Title: 2” top margin
    Centered (school name, team name, task number, advisor name, and team member names)
  Spacing between title entries (school name, team name, etc.): 1.5 line

• Body of paper:
  Top and bottom margins: 1"
  Right and left margins: 1"
  Left justified, ragged right edge
  Spacing: 1.5 line

• Footers: Required on each page.
  School name and task number: Centered
  Page number: Centered below school name and task number

• Headings
  Title: Center, upper case, bold; 14-point type
  Major Headings: Left justify, upper case, bold; 12-point type
  Subheadings: 1 tab (5 spaces); bold, 12-point type
  Sub-subheadings: 2 tabs (10 spaces); underline, 12-point type
  Leading below headings: no more than 6 points. (Leading=vertical distance between lines of text)

• References
  Use superscript numbers when referring to references in the text.
  List and number all bibliographical references at the end of the paper.

• Equations
  Italicize variables in equations.
  Center equations; right-justify equation numbers and enclose them numbers in parentheses.
  (Hint for aligning these: enter equation and its number in a 1-row, 2-column table)

• Figures and Tables
  Number figures consecutively and refer to them in the text, as appropriate (Figure 1, Figure 2, etc.)
  Table/Figure captions: left-aligned below the figure/table; Include figure/table number, ending with a period; the description will be in sentence case.

• Symbols and Abbreviations
  Use only standard symbols and abbreviations in text and illustrations.

• Illustrations, Drawings and Photographs
  –Line drawings and photographs should be essential to the paper, reduced to proper size, and placed within the body of the paper, as close to where they are referenced as possible.
  –All lines and images should be sharp and easy to read.
  –All lettering should be large enough to be legible.
  –Original illustrations should not exceed 8.5” X 11”.

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Required Elements of the Written Report

1. The paper must include:
   - A report cover identifying the school and task (not included in the page limit)
   - A title page with school, team, task, advisor, and team member names (counted as the first page)
   - A table of contents
   - An executive summary (maximum of two pages) highlighting the proposed solution
   - The report body (see #2, below)
   - Illustrations, photographs, and graphs (included in the page count)
   - References (included in the page count)
   - Audits (see #3, below) – These are not included in the page count.

2. The body of the paper must include (See PART II for full discussions of these sections):
   - Background research
   - Description of your team’s solution
   - Test data
   - Technical evaluation of the performance of your team’s solution.
   - Bench-scale/prototype lab results
   - Full-scale design description, calculations, costs, and implementation schedule.
   - Waste generation considerations
   - Business Plan
   - Health, Safety, and Environmental regulations
   - Community Relations Plan (recommended efforts to encourage public acceptance)
   - Conclusions

3. Executive Summary
   Judges use the Executive Summary as a reference. The executive summary is a concise overview of the entire project. From it, the reader should be able to understand the task, the options considered, the process selected, the project costs, performance, schedule, and the conclusions reached.

6. Audits: Teams are required to include three separate audits to address:
   - Economics
   - Health Issues
   - Legal Issues

   The audits should be made by professionals involved in each specific field.
   Suggested auditors: faculty members, industrial representatives, experts, doctoral students, etc.

   Audits should be 1-2 pages (not an edited copy of your paper);
   Audits will not be counted toward your page count. Each should not exceed 2 pages.

4. Rights: The report should be non-proprietary and omit product trade names.

Submitting reports
- Upload one PDF per team of the complete report, including audits, to the team’s WERC account.
- Only faculty and/or team leaders have access to upload the report.
- Deadline: **11:59 PM, March 23, 2020** (your time zone)
- Late reports will be penalized by 25 points per day. Re-submitting your report will replace the previous version and also update the time stamp. (Use caution if re-submitting after the deadline!)
Judging Criteria for the Written Report

- Executive summary quality; includes engineering basis for design and summary of results.
- Equipment and process selection based on in-depth research of process and equipment.
- Discussion of lab results, testing, process monitoring, and waste generation.
- Discussion of scale-up (technical, costs, implementation schedule, etc.)
- Discussion of legal, health, and safety (worker and public) implications for the entire process.
- Economic analysis, business plan, and/or cost/benefit discussion.
- Professional audits/public involvement.
- Overall quality: grammar, organization, succinctness.
- Late Submission deduction (25 points per day late)

WERC IEEE Conference Proceedings

Starting 2020, the WERC Environmental Design Contest will become an IEEE conference. We will publish a select number of WERC contest entries in the IEEE Conference Proceedings. Publication in the conference proceedings will be competitive among all 2020 WERC teams. All members of the team and their Faculty Advisor and Co-Advisors, if any, will be listed as authors of the paper.

There is no limit to the number of teams invited to submit papers. The invitation will be based on the quality of the paper, as determined by the judges.

If your team is invited to submit a paper for the conference proceedings, we will email the Advisors and Team Leader the formatting guidelines for the paper after the contest. Teams will be invited to submit an abbreviated version of their paper, formatted for the WERC IEEE Conference Proceedings.

About the IEEE Environmental Engineering Initiative

IEEE is the world’s largest technical professional organization dedicated to advancing technology for the benefit of humanity. IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities. (https://www.ieee.org/)

The IEEE Environmental Engineering Initiative intends to create an interdisciplinary forum for the community interested in the area of environmental engineering, including components in various S/Cs which are using our technologies and methodologies but are not yet embraced by our IEEE communities. Through the initiative, the IEEE community will:

- Share experiences and efforts
- Improve interdisciplinary vision
- Reach out to under-served technical segments
- Embrace and empower the whole community working on environmental engineering
- Expand knowledge dissemination (conferences, publications, curated collections, webinars, educational activities)
- Contribute to expanding people networking
- Contribute to supporting standardization activities
Oral Presentation Guidelines and Judging Criteria

Regulations and Logistics
1. **Presentation Time Limit**: 15 minutes
2. **Question/Answer period**: 10 minutes
3. **Setup and breakdown time**: total of 5 minutes
4. **Presentation locations**: Presentations are happening in four rooms at one time.
5. **Point deductions**: 25 points deducted per minute over the Presentation Time Limit
6. **Presenters**: A maximum of four team members may present. Only these four may answer judges’ questions at the end. Violation of this rule will result in a 25-point deduction.
7. **Media**: PowerPoint presentations must be on the team’s computer. The computer will be plugged into the AV system at the venue. Watch FAQs for connection compatibility info.
8. **Audience**: Judges who, acting as your client or plant manager, will decide if your designs are technically, logistically, and economically viable.
9. **Secondary Audience**: Teams from the participating school. The Las Cruces community may be invited; Judges prefer that the faculty advisor not be in attendance, as it can hamper the students’ presentations. Competing teams are not allowed in the room during a presentation.
10. **Videotaping**: Is not allowed.
11. **Goal**: Convincing your client (a.k.a. the judges) that yours is the optimal solution for the task.
12. **Introductions**: The team leader will introduce the presenting team members to the judges at the beginning of the presentation.
13. **Conclusions**: End the presentation with a discussion of conclusions. Finally, ask the audience if they have questions.

Preparation:
1. Dress in business attire (Dress for Success!)
2. Prepare a confident, technical and business-like discussion of your solution.
3. Include all essential elements from the body of the written report (See #2, Page 6).
4. Include citations at the bottom of each slide.
5. Use graphs, charts and figures to illustrate trends and report findings.
6. Be concise. The judges have already read the report. Make the most important points.
7. Anticipate questions: The judges, like a manager or client, will usually identify a weak area in your logic or presentation and probe it. If you do not know the answer, do not bluff. Promise to look it up and discuss it during the bench-scale demos on the following day.

Judging Criteria
- Professional delivery and effectiveness of presentation; apparent full-team participation
- Effectiveness of audio-visual materials; essential figures (process flow sheet, material balance, etc.)
- Technical presentation: inclusion of key sections (technology alternatives, bench results, scale-up, business plan, health, safety, environmental regulations)
- Discussion of results: justification and advantages of proposed solution.
- Ability to answer judges’ questions.
Bench-Scale Demonstration Guidelines

The bench-scale demonstration is often the favorite part of the contest for both the judges and contestants. Many judges volunteer their time because of the satisfaction they receive in interacting with the students. Have fun and be prepared.

Regulations and Logistics

1. **Experimental Safety Plan: Due March 9, 2020.** The ESP is submitted online through the WERC team site. Start submitting your plan at least three weeks prior to the due date: the ESP has many steps, each of which must be approved by WERC’s Safety Officer before the team is allowed to run their demonstration at the contest. There is a per-day point deduction for submitting the ESP late.

2. **Safety at the contest** (see next page for general schedule):
   a. Safety Meeting: Held on the first day of the contest to introduce safety staff, discuss safety, permits, decommissioning, etc.
   b. Teams must obtain a Safety Operating Permit from WERC’s Safety Officer prior to running their demonstration. We begin issuing permits after the Safety Meeting.
   c. Points will be deducted for Safety Citations, accidents, injury, or illness due to ignoring safety protocols.

3. **Safety and Judging:** When they come to your demonstration, judges consider your team’s: wearing of personal protective equipment, ability to identify potential hazards, and implementation of safety protocols. Be sure to provide judges with their own safety equipment, if needed.

4. **Booth size and equipment:** see next page.

5. **Sample testing:** Your bench-scale demonstration is tested on-site on Monday and Tuesday. If it is a chemical process, on Monday, you will be handed a pre-mixed solution of the same composition listed in your Task Problem Statement. The results of your process will be delivered to NMSU’s analytical labs for component evaluation. Lab results will be reported to judges.

If a non-chemical process, the Task Problem Statement will outline how your bench-scale model will be tested.

Open Task projects should submit their task plan by February 3, 2020 to allow WERC staff to prepare for analytical testing.

Judging: Judges (usually 4-6 people) come to your booth in three 30-minute shifts, allowing teams to present their results three times. This is your chance to show judges what you were talking about during the oral presentation and to answer any un-answered oral-presentation questions.

Prepare and rehearse how you will present your demonstration for the judges. Be prepared to run the experiment in their presence.

6. **Visitors:** We invite the Las Cruces community, including students, to attend the bench-scale demonstrations. Take every opportunity to practice your presentation on visitors–It is fun and may help you identify unexpected questions.
Bench-Scale Demonstration: Booth size, Equipment, Permit Process

<table>
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<tr>
<th>Time/Day</th>
<th>Event</th>
<th>Description</th>
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<tr>
<td>Sunday 2 - 5 pm</td>
<td>Bench-scale set-up</td>
<td>The space available to each team will be a 10' X 10' area. Electrical outlets (110), and a 6' folding table will be available in each booth. Upon request in advance, water, air, and vacuum can be made available to each team. Other utilities such as gas must be provided by each participating team. A modest supply of hand tools and construction materials will be provided. Additional material will not be available unless special arrangements are made ahead of time. Some chemicals can be obtained on campus through the NMSU’s Main Stockroom (Tom Reichardt, manager). The Chemistry Stockroom is located in room 103 the Chemistry &amp; Biochemistry Building (building 187) located near the top of Horseshoe Drive on the University Street side. Purchases for general chemicals and supplies may be made by cash or check. Just stop by and ask or call 575-646-4330 for availability and pricing. Hours are 8:30 am – 9:00 pm Monday-Thursday and 8:30 am – 5 pm Friday. Prior to running your process on Monday, a Safety Operating Permit is required. No processes will run on Sunday, but we will begin issuing Safety Operating Permits on that day. Safety Operating Permit includes: MSDSs, Safety Summary, NFPA Placarding (provided by the WERC Safety Team), and team emergency contacts. The bench-scale area closes promptly at 8:15 PM.</td>
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<td>Sunday 6:45-8:15 PM</td>
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<tr>
<td>Monday 8 am</td>
<td>Sample distribution</td>
<td>For each appropriate task, a test sample will be made containing one or all of the contaminants listed in the design statement. Handout of the samples will begin on Monday morning at 8:00 am. Using appropriate methods, the sample integrity and its homogeneity will be preserved. Additional test sample instructions are included on the Task Problem Statement.</td>
</tr>
<tr>
<td>Monday</td>
<td>Bench-scale operational</td>
<td>Prior to running your process, a Safety Operating Permit is Required. If you did not obtain a permit on Sunday, apply Monday morning.</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Bench-scale and poster</td>
<td>All teams will present their bench-scale and poster presentations several times to teams of judges. Please follow the schedule in the handbook that will be given to you when you arrive at the contest.</td>
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<tr>
<td></td>
<td>judging</td>
<td></td>
</tr>
<tr>
<td>Monday &amp;</td>
<td>Sample Evaluation</td>
<td>The results of the samples will be evaluated using analytical equipment located on the NMSU campus. A secondary outside lab may be used to confirm first-place results.</td>
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<td>Tuesday Evening</td>
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<tr>
<td>Wednesday 8 am-Noon</td>
<td>Bench-scale take down</td>
<td>Bench materials must be packed and shipped or disposed of properly by noon. The bench-scale area will be closed at noon.</td>
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Bench-Scale Demonstration Judging Criteria

- Originality, craftsmanship, and suitability of the bench scale construction.
- Effectiveness, functionality, yield, and overall performance of demonstration
- Completeness of the bench scale process.
- Cost effectiveness, scalability, processing time, ease of use, reliability, etc.
- Safety, environmental & public health considerations, secondary waste generation, OSHA, ES&H plan, etc.
- Bench-scale process operation safety (negative points are assessed for safety violations)
- Communication and ability to answer judges’ questions
- Analytical test results

Poster Specifications

1. Only one poster board will be created for each task.
2. Maximum size: 48" X 48".
3. The cost for the preparation of poster displays and presentation material should not exceed $250. This amount includes the associated value of all materials used or donated for the presentation. Ten points will be deducted for exceeding this limit.
4. The poster presentation will be scored at the same time as bench-scale presentation.

Poster Judging Criteria

- Effectiveness/organization in conveying overall message on poster
- Strength of graphic impact
- Effectiveness/professionalism of students’ discussion of poster
- Ability to address judges' questions

Experimental Safety Plan (ESP) Overview

General Instructions

An Experiment Safety Plan (ESP) is required for every experiment conducted at the WERC Design Contest. The ESP ensures the safety of all by identifying the safest possible methods to conduct an experiment. By signing the ESP, the individuals conducting the experiment, College of Engineering Safety Specialist (COE Safety), and the faculty advisor acknowledge responsibility for the following.

1) Appropriate Personal Protective Equipment (PPE) must always be worn while in the bench-scale demonstration area, as described in the ESP. The minimum required PPE to enter: 1) long pants, 2) closed toe shoes, 3) lab coat or long-sleeve shirt, and 4) safety glasses with side shields.

2) No researcher is permitted to work alone in a lab at any time, for safety reasons.

3) Two-phase ESP approval:
   a. Phase I –Written safety plan (includes an evaluation by College of Engineering (COE) Safety Officer (and if appropriate by EH&S) to: establish controls of hazardous operations, avoid the purchase of inappropriate supplies, and establish expected waste(s) streams. Approval of the written plan online by COE staff is permission for the team to bring their experiment, equipment, and necessary chemicals to the WERC Design Contest.

   b. Phase II –approval on-site at the event. It requires evaluation of the assembled experiment and a “dry run” of the experimental procedure. Upon approval, the team may acquire sample solutions and begin operation of their experiments.
Experimental Safety Plan (ESP) Instructions

The eight required submissions for the ESP are:

1. Experimental Scope
2. Drawing of Experimental Layout including P&ID
3. Normal Operation, Startup and Shut-down Procedures
4. Emergency Shutdown Procedures
5. Waste Management Procedure:
6. Hazard Identification and Mitigation:
7. Other Equipment Needs
8. Safety Data Sheets

These ESP submissions are described on the following two pages.

Experimental Scope

Provide a concise description of the laboratory experiment to be undertaken.

1. Explain why the work is being performed and the goal(s) of the experimental program. If this is an update/revision of a previous ESP, describe all changes.

2. Provide the stoichiometry of any chemical reactions and their heats of reaction.

3. Demonstrate the inherent thermal safety of your experiment through calculation or through the use of accelerating-rate calorimetry data. https://chme.nmsu.edu/research/ehs/experimental-safety-plan-esp/esp-energetics-calculation/)

4. Include a complete list of all chemicals (reactants and products) involved in the work.

5. Include a complete list of all equipment (e.g. autoclave, centrifuge, pump, heat bath etc.) involved in this work.

6. Include a timeline for this experiment including setup, sample runtime(s), and teardown. If the experiment is required to run after hours, explain how the after-hours run will be addressed (i.e. will the equipment operate autonomously, or be monitored remotely, or be monitored by someone onsite; if any of these, for how long? Or indicate other scenarios.)

Drawing of Experimental Layout including Piping and Instrumentation Diagram

Provide a detailed drawing of the experiment including P&ID’s showing all flow of inputs and outputs for equipment and system. Note that this is required for all ESPs.

Normal Operation, Startup, and Shut-down Procedures

Provide a step-wise procedure that describes in detail how the work will be performed.

1. Begin and end the procedure with the equipment in the normal idle (inoperative) state.

2. Include a statement of the required PPE, starting at the beginning of the procedure and at every location in the procedure where the PPE requirements change.

3. Include details of how you will meet the required elements of your chosen task (e.g. run time, run rate, sample rate etc.)

4. Indicate where hazardous feedstock chemicals will be stored, how they will be transported to the location of the experimental work, how they will be transferred from storage vial into the experimental apparatus, and how they will be returned to storage.

5. Take into account those items for which you indicate “yes” on the WERC Lab Hazard Assessment Checklist (See the Attachment Tab).
Emergency Shutdown Procedures
1. Provide a step-wise procedure that describes how the equipment will be brought to a safe state in the event of an emergency. Consider emergency situations such as loss of power, leaks, fire in your equipment, fire in the surrounding lab area, etc.

2. The description should include a detailed explanation of how to attend to potential medical emergencies that may result.

Waste Management Procedure
Prepare a Waste Management Procedure that indicates the exact nature and estimated volumes of all wastes to be generated during the experiments. NMSU will provide containers and forms for proper disposal of materials. NMSU will dispose of on-site waste when placed on proper containers. (See website “Guidelines” for examples of the NMSU Waste Tracking Form, NMSU Waste Sticker and photos of containers.)

Hazard Identification and Mitigation
Identify and discuss ALL HIGH hazards associated with the experiment. Use the WERC Lab Hazard Assessment Checklist as a guide. (See the “JHA Lab Hazard Checklist_Example” on WERC website.) When in doubt about whether something represents a HIGH HAZARD, ask COE Safety for a determination.

The Hazard Identification and Mitigation analysis must consider:
- all sources of energy (electric, chemical, hydraulics, mechanical, compressed gases);
- extreme conditions of pressure or temperature (from flame or steam to cryogenics);
- chemical use and storage;
- housekeeping;
- fire potential;
- biological hazards.

The discussion must include:
1. Description of the HIGH hazard;
2. Operational and engineering controls that will be used (based on identified industry best-practices used in addressing this safety hazard);
3. Required PPE (beyond minimum) when this HIGH hazard is present; and
4. Special training (beyond minimum) that is necessary.

Other Equipment Needs:
Provide a list and details of any equipment you require that will not, or cannot, be shipped to the event. We have several items available for use and can let your team borrow them, but you must tell us in advance what you need.

Examples include scales, balances, electrical test meters, hand tools, secondary containment vessels (e.g. kiddie wading pool for water containment), easels, stands, brackets, clamps etc.

Safety Data Sheets
Provide SDS documents for all chemicals used at the event, including household and consumer products.
Preliminary Report Guidelines—For specific tasks that require this

Your team needs to submit a Preliminary Report only if this is indicated in the Task Problem Statement.

The purpose of the preliminary report is to ensure that you understand and are following the guidelines of the published Task Problem Statement, and to ensure that you are heading in the right direction with your solution. Take the report seriously—reviewer comments could lead you in a better direction than you had originally planned.

Organize your report to make it easy for the reviewer to find information:
1. Be brief.
2. Use clearly-marked headings (such as “Chemical Pretreatment”, “Mechanical Pretreatment”, “Thermodynamic Analysis”, etc., according to the requirements of the Preliminary Report.)
3. Avoid long paragraphs of text. Help the reviewer find the pertinent information through numbered or bulleted lists. (This is not a time for complete sentences or flowery prose.)
4. Double-check the problem statement to ensure that all requirements for the report are met.

If you only need 1/4 page for the report, that is fine. Please do not turn it into an essay—Help the staff at Freeport-McMoRan quickly find the information they need.

Test Plan Guidelines – For Open Task participants only

The Test Plan is reported through the ESP.

The purpose is to help our staff prepare to test your solution. Our Analytical Testing Officer and our Safety Officer will evaluate your plan and make modifications, if needed.

If you have questions about specific requirements for your problem statement, please contact us.

To prepare your ESP for your team-defined Open Task, be sure to include these items:
1. **Problem Statement** (What is the problem? and Why does it need to be addressed?). This should not be lengthy (4-8 sentences or bullet points).
2. **Approach** to the solution (Describe in one-two sentences).

The ESP will guide you through the following checklists:

3. **Chemicals Used/Materials Used:** you will be using. (Use a numbered list to list all chemicals, materials, and equipment you will use)
4. **Synthetic solutions needed.** List chemical solutions you need WERC to pre-mix and give to your team to run through your bench-scale apparatus.
5. **Materials needed.** List all equipment you need WERC to provide (items that you are not able to bring to the contest).
6. **Testing methods** that will be needed to show success with the process (If a chemical process, list each specific chemical analysis that is needed to demonstrate success; If a non-chemical process, indicate all measurements that our labs need to make to demonstrate your team’s success.)
7. **Additional items.** Above is the minimum required for the Test Plan. Your specific task may require that you submit more information.
WERC Environmental Design Contest Award Selection Criteria

**First, Second, and Third place awards for each task ($2500, $1000, $500)**

The winning team is the one with the highest score in all four elements of the task (written, oral, bench poster) and also has appropriate bench-scale results.

The number of awards depends on the number of entries per task. We apply the 1/2 rule: No more than 1/2 of the entries will receive awards. This is because for example, if there are 3 entries in one task, there will be a First-Place award only. If there are six entries, there will be First-, Second-, place awards, etc.

**Judges’ Choice Awards ($500+)**

Judges select teams that distinguished themselves in all four elements of a task. Multiple awards are possible.

**Freeport-McMoRan Innovation in Sustainability Award ($2500)**

An award for the team that creates the best overall innovative product, process or solution to a land management, energy, water and/or air or other sustainability issue(s); and meets FCX’s (Freeport-McMoRan’s) approach to Sustainable Development and Resource Conservation. Selection Criteria:

- Potential for real-life use and implementation
- The degree to which the proposed product, process, or solution successfully addresses a land management, energy, water and/or air or other sustainability issue(s).
- Demonstration of Physical, Chemical and Ecological effects on Sustainable Development as it relates to land, energy, water, and/or air.
- Energy and water-use efficiency.
- An understanding of the Operational, Environmental, and Social Impacts of Product/Solution or Method including upstream and downstream issues.
- Affordability, cost effective operation, and maintenance; quality of cost/benefit analysis including all sustainability elements or selections made in developing the product/solution/method.
- Overall potential environmental, social, and economic benefits.

**Outstanding Student Award in Memory of Intel’s Terry McManus ($500+)**

To honor his memory, in 2006 Intel created the Terry McManus Memorial Award to be given to a student or students who demonstrates the same drive Terry had. Terry loved coming to the Design Contest every year and seeing students who shared his goals for environmental excellence. This memorial award is given to a student who demonstrates a passion for the environment. Up to three students may win the award each year.

Each team may nominate one student among their team. The name is given to the advisor.

The advisor writes a 1-page nomination letter describing why the chosen student is deserving of the award. The writeup should demonstrate the student’s commitment to environmental excellence and a passion to pursue global environmental improvements.

Nomination letters are distributed to the judges for the final decision.

The nomination letters are due by the first day of the contest.
They may either be emailed to werc.nmsu.edu or brought as a hard copy to the registration table.

**Pollution Prevention/Energy Efficiency Award ($500)**

Awarded based on the team's demonstration of an understanding and implementation of:
- significant reduction or elimination of wastes at their sources,
- reduced generation of greenhouse gases,
- reduced use of hazardous materials,
- conservation of water and air resources,
- utilization of sustainable materials, and/or
- energy efficiency measures.
Flash Talk Competition—Judged separately from other awards.

Flash Talk Guidelines Subject to Change—Watch for updates on the website (see “Guidelines” page).

The Flash Talk Competition prepares students for entrepreneurship as it challenges teams to “sell” their WERC Environmental Design Contest solution to a non-technical audience—in only three minutes! (Note: No start-up funding will be issued, but top teams will win cash awards.)

Teams will compete for cash awards according to the number of points assigned by a team of 5-7 judges. **Cash Awards:** First $1000; Second $750; Third $500; Audience Favorite $250

The Flash Talk competition:
- Similar to an Elevator Pitch, but with PowerPoint slides added.
- Scored independently from the other stages of the contest.
- Helps satisfy ABET Student Outcome #3: an ability to communicate effectively with a range of audiences.

Audience
In the audience will be the Flash Talk judges, all Design Contest teams and advisors as well as citizens of Las Cruces (including members of local environmental groups and students from local high schools).

The audience will vote on a crowd favorite and will likely place votes based on the most interesting, understandable, and aesthetically appealing presentation.

Judges
The Flash Talks are judged by a team of 5-7 Judges who are independent from the judges of the main four-stage Design Contest. They will not have worked with any teams or read team reports prior to the Flash Talk Competition.

Judges will have a broad range of backgrounds: some with experience funding entrepreneurial projects and others with interest in environmental issues. They may or may not have a background in science and engineering. For this presentation, eliminate all jargon.

Judges will be:
- Staff of the Arrowhead Center (Flash Talk sponsor), an NMSU Community for Entrepreneurship and Innovation;
- Staff from X2nSat (Flash Talk sponsor), a leading satellite communications company.
- New Mexico environmental proponents (may include business owners, students, etc.).
- Investors who have participated in regional “Shark Tank” events.
- Audience members from the community will vote, resulting in the “Audience Favorite” award.

Objectives and Slide Template
These seven required slides will help you convince a philanthropist to “invest” in your technology.

- **Cover Slide.** Presents the title, presenter, team, university.
- **Problem.** The problem your team is trying to solve and why it is important;
- **Solution—Bench Scale.** The innovations that make your solution superior to previous/alternative technology; Preliminary results you have obtained;
- **Solution—Scale-up.** Your team’s proposals to implement the solution (Scale-up solution) (timetables, structures to be built, waste, health/safety, community acceptance, etc.);
- **Solution—Wrap-up.** Additional information about the solution, Product value proposition, product line-up, etc.
- **Business Plan.** The economic and logistical feasibility of your solution;
- **Wrap-up.** List your competitive advantages, your plan to win, a call to action, challenge, or success report.
PowerPoint Slide Presentation Specifications

- **PowerPoint Slides**: Each team will prepare a set of PowerPoint slides (.ppt or .pptx format)
- **Slide Template**: Teams must use the 7-slide template (available online—see “Guidelines”).
- **Maximum number of slides**: 9 (teams may add 2 slides to the 7-slide template)
- **Presentation Time Limit**: 3 minutes
- **PowerPoint Submission**: Slides are due no later than Monday, April 6, by 2:00 PM.
- **How to submit slides**: TBA. Watch Flash Talk FAQs.
- **Submission locked**: Once the slides are submitted, they cannot be changed.
- **Contest slideshow**: All slides will be combined into a single PowerPoint presentation.

**Slide Format**:
- **Type**: minimum of 30 points.
- **Place text or important images within the top ¾ of the slide**.
- **Use high-contrast colors for background/text to ensure readability from long distances**.
- **Cover Slide**: The first slide will be a cover slide indicating:
  - Project title
  - Team name, school name, school logo
  - Name of presenter, names of team members.
- **Slides may contain simple animations and may contain video**: one video counts as one slide.

- **Dress**: Teams are expected to dress in a professional manner.
- **Presenter(s)**: We recommend that only one person present the Flash Talk. More are allowed, but due to time constraints, and the need to share a microphone, we recommend no more than two.
- **Microphone**: The microphone should be used for all oral communication with the audience. The mic is mounted to a podium. Only one person will stand at the microphone at one time.
- **Team members** who are not at the microphone will stand on/near the stage during the presentation. They may help forward the presentation by displaying equipment or demonstrating what the speaker is saying, but they should not speak, nor should they block the screen.
- **Timing**: The clock begins to run as soon as the presenter begins speaking. The timekeeper will hold up a sign when the presentation is within thirty seconds of the time limit. A buzzer will sound at the end of the three-minute period to signal that the presentation has ended. Going over time will result in a point deduction.

**Logistics**

- Each team will be given 3 minutes to make their pitch.
- The next team should be “on deck,” and step up to present their pitch within 15 seconds of the previous pitch. The team will wait for the signal to begin (after judges score the previous team).
- There will be no Question/Answer session: The presentation should say it all.
- Each team will submit PowerPoint Slides to the WERC site by **2:00 PM MST, Monday, April 6, 2020**.

**Flash Talks Scoring Criteria**

Scoring will assess your success in conveying: Content (addressing “Objectives,” above) and Delivery (clarity, ability to address a non-technical audience, and impact of presentation).

- Audience engagement
- Organization and preparation
- Clear presentation of problem and solution to non-scientific audience
- Clear target audience and benefits to that audience
PART II: HELPFUL HINTS

Want a better chance of winning? Find valuable hints here.

General Helpful Hints
We have gathered these ideas from watching the most successful (and less successful) teams.

Team Composition
1. The “Perfect” team is one that works well together and consists of members who have a strong work ethic and a plan to improve an engineering process. Your Advisor will guide team member selection.
   Successful team composition varies. There is no rule of thumb for this:
   a. For some successful teams, every member is of the same major.
   b. Some successful teams are multidisciplinary: Chemical, Civil, Environmental, Mechanical, Electrical Engineering, Science, Tech Writing, Economics, Safety, Art (design the presentations), etc., can all work on the same team.
2. Select a team leader who is organized and has leadership capability as well as knowledge in laboratory procedures, safety aspects, and chemical clean-up.
3. Keeping the same advisor (and/or passing along helpful hints for approaching problem solutions from year to year) is an advantage for the team.

Financial sponsorship:
Seek financial support from your community:
   a. Local businesses/organizations who are considered “Friends of the Environment” (or turn them into “Friends of the Environment” as they sponsor your team!)
   b. Your academic department or school.
Be sure to recognize sponsors by posting their logos and sending thank-you notes.

Travel:
1. Keep track of expenses for budgeting reasons for the next year.
2. Bring your computer, printer, and other technology to the contest with you. You may need them for another copy of the paper, to correct the board, or do other tasks you didn’t have time for before arriving.
3. A trailer or extra vehicle is good to rent to carry equipment and luggage,
4. Put equipment and the bench-scale items in a secure place.
5. If you are not bringing your equipment with you, ship it by FedEx or UPS and track it yourself—lost shipments are not uncommon, but with tracking, they have always been recovered in time.
6. Check out cool spots to see in New Mexico: White Sands, Very Large Array, Sun Spot side trips enrich the experience and help bond the team for future work together.
7. The El Paso Airport is an hour’s drive away from Las Cruces.

Contest in general:
1. Dress to impress; look, act, and dress as professionals in your field.
2. Have your team set-up a realistic time-line and follow it.
3. Take time to network while at the contest. Talk to people, whether they are students or judges or local college students. If they are professionals, get their cards.
4. Don’t just sell your process, sell yourselves.
5. Bring extra copies of your paper with contact information, in case they want to recruit you or get additional information.
6. Bring your resumes. If you are not graduating, there may be internships available. If you are graduating, there may be a job available.
7. Bring your research to the contest; all of it may be useful and if it is well organized, you will be able to answer questions from the judges you did not anticipate or put in the paper.

8. Make personal card for yourselves, with contact information. This is in addition to any you may make for the oral presentation. Brochures for the oral and poster presentations are nice touches.

9. Your team may benefit from tracking the hours spent on different areas of concern: research, testing, writing, etc. After tracking their time, they would know how valuable their work really is.

10. The first year of participation is the toughest because teams do not know what to expect.

Follow-up:
After the competition, write down what you have learned and pass it down to next year’s teams at your school!

Organization:
1. Print and keep handy for all to read: Task Problem Statement, Team Manual, Judging Criteria, FAQs, and Deadlines. We recommend that the team keep a binder in the lab that is tabbed and accessible at all times. Everyone needs to read all material.
2. Assign a team member to check the website weekly. Especially the FAQs.
3. Make check lists for everything: 1) judging criteria, 2) requirements, 3) equipment to pack, etc.
4. Stay organized; have one person organize all research information logically and accessibly.
5. Learn to expect and deal with change. Don’t sweat the small stuff. What’s done is done–Move on.

Research:
1. Throw nothing away, even if it only touches on the project. Some of the most creative solutions came from minor points mentioned in papers not directly concerning the task.
2. Contact a mentor with expertise in the area early and often; he or she may help you find research papers, and you need as much primary research as possible.
3. Don’t be afraid to go to the top to find information or resources; top people can help, and they won’t look down on you—they will be excited if you are informed and enthusiastic.

Understanding the Task Problem Statement:
Judges report that the most common deficiencies in all aspects of the contest are:
1. Not understanding the problem statement.
2. Not addressing all required topics outlined in the problem statement.

Hint: Carefully read and discuss the Task Problem Statement aloud as a group at least once per week during early stages. Later on, review it aloud periodically. Make checklists to remember all requirements.
Hints for Writing a Great Report:
Your team’s written report is the first thing the judges see. They read and evaluate each paper while checking it against the judging criteria and against every other paper in the same task. Judges tell us that they can frequently predict whether a team will win/not win, based on the quality of the report—a team’s general attention to detail is strongly reflected in the way they write the report.

The Written Report constitutes 30% of the total score. Pay attention to detail and follow all helpful hints. Written Report Requirements are listed in Part I. Refer to them often.

General Paper Preparation Hints
- Use well-written professional papers as models for your paper organization. The judges are accustomed to reading scientific writing style—be succinct; omit flowery, undocumented writing.
- Cite sources as you go; you may not be able to find the source again—trust us on this!
- Seek feedback on your proposed solution from local engineers and end-users of your solution.
- Ensure that the paper flows in a logical way. Use proper headings to allow judges to find information.
- Include a timeline for the industrial installation, scaled up from the bench scale solution.
- Work carefully on the computations for the full-scale product. Remember that scale-up designs do not necessarily just multiply from your bench scale.
- Cost-effectiveness is a key issue; collect numbers as you research, and keep cost in mind as you refine your solution: Remember to consider permit fees, construction costs, architect fees, etc.
  A professional in the field, such as your city manager, may be able to help.
- Rough-finish the paper at least three weeks before the paper due date, in time for two weeks in the auditor’s hands and a minimum of one week for the team to incorporate changes. You might need to do more research after the auditors respond.
- Make sure the paper includes all requirements, including the audits.
- Have your paper proof-read by a professional writer/English professor. Follow their recommendations.
- Use your auditors’ comments; the more expert the auditor, the better the quality of the paper.
- Select several reviewers, including auditors, with combined professional experience covering all elements of your paper. At least one reader should be a strong editor, another should have a strong technical background, and another should have no previous knowledge of the subject. When someone who knows nothing about your task can understand your paper, you will have assurance that your paper communicates the desired message.

Hints for Completing Sections in the Written Report
- Executive Summary
  The Executive Summary is a concise overview of the entire project. From it, the reader should be able to understand the task, the options considered, the process selected, the project costs, performance, schedule, and the conclusions reached.

Common deficiencies in executive summaries noted by judges:
1. Copying the problem statement from WERC’s materials instead of restating it concisely in a manner that reflects knowledge of the problem.
2. Devoting too much space to the task problem statement. In many executive summaries, the problem statement was over half of the length of the summary. Spend enough space on data, findings, solutions, costs, health, safety, waste, etc.
3. Failing to cover all the aspects of the paper in a brief, concise manner. The summary should be a stand-alone document that fully summarizes the paper.
4. Going into too much detail. As a summary, it should be succinct.
• **Body of the Report**

The body of the paper provides the details of your project. It must be complete and written in a logical order that leads the reader to your team’s conclusions. It should include all of these:

1. A discussion of the technology alternatives considered for the task.
2. A discussion of the full-scale design, based on the bench-scale development and laboratory results.
3. A business plan with cost, schedule, and performance data.
4. A discussion of health, safety, and environmental regulations.
5. A community relations plan.

Judges commonly observe the following deficiencies in the body of the report:

1. Not enough research into the background/history of the problem.
2. Insufficient research and discussion of viable technology alternatives. This section of the report should cover all the technologies considered, indicate pros and cons for each, and reflect the logical thought process by which your team designed the full-scale solution.
3. Failure to cover all topics required by the problem statement.
4. A weak justification for the technology selected.
5. Data not clearly summarized.
6. Insufficient discussion of laboratory-scale experimentation and/or insufficient laboratory data to validate the final solution.
7. Failure to communicate: difficult-to-interpret illustrations, missing data, unclear prose, etc.
8. Poor paper organization. Make it easy for judges to find information by naming section headers appropriately and placing information under the proper section header.
9. Lack of balance in paper. No single section should overpower another.
10. Failure to follow auditors’ recommendations.

• **Full-scale Design Description**

The discussion of the full-scale design should reflect the logical process that led from the development of your bench-scale process to the full-scale design.

Judges have noted the following deficiencies in the full-scale design section of the report:

1. Failure to apply fundamental engineering principles and concepts (such as conservation of mass/energy, Laws of Thermodynamics, Physics, etc.).
2. Failure to show, in a logical manner, how the solution meets the requirements.
3. Poor documentation of the laboratory set-up and results.
4. Failure to provide sufficient data to reflect an understanding of the task and its solution.
5. Ignoring secondary wastes, especially hazardous secondary wastes.
6. Lack of process flow diagrams with appropriate mass and energy balances.
7. Failure to appreciate the physical and chemical problems of scale up.
8. Designing processes that cannot be scaled up from bench-scale to full-scale because of inadequate consideration for health, safety or environmental hazards.
9. Confusion between the bench-scale and full-scale process. If using surrogates in the bench scale, there will likely be significant differences between the bench-scale and full-scale process.
10. Exaggerating one hazard over another (e.g., being overly concerned about traces of plutonium when the real threat is a hazardous chemical present in the mix). Conversely, radiation at potentially lethal levels generally makes the presence of other hazardous substance immaterial. You must understand and evaluate these issues on a case-by-case basis.
• **Business Plan**

The business plan is critical to your design. No manager will support construction of a facility or process that is not economically sound. Find a technical reviewer from industry to advise your team on all of the issues below.

Judges have commonly noted the following deficiencies in business plans:
1. Project and construction schedules are missing.
2. Critical market costs are missing references.
3. Life-cycle cost analysis is missing. The construction project approach should not be too limited.
4. Insufficient detail - cost elements such as overhead, maintenance, labor, utilities, operations, and equipment are not itemized.
5. Poor documentation of cost information. Judges often note that no sources are provided but cost “estimates” are often stated to the nearest penny.
6. Limited investment decision information and/or no return-on-investment calculations.
7. Costs that are not compared with the cost of a current baseline technology.
8. A lack of understanding of the relationship between cost and the potential for implementation of a process.
9. Failure to understand the relationship between cost and regulatory impacts such as negotiations and redesign.
10. No costs attributed to engineering development.
11. Regulatory considerations that impact the cost, schedule, and overall feasibility of a process is often weak. If there are standards with abnormal effects on the process, design, or waste streams, be sure to note these effects and how you plan to reduce or mitigate their impact.

• **Health, Safety, and Environmental Regulations**

The health, safety, and environmental section of your paper should provide an overview of applicable regulations. However, just listing the applicable regulations is inadequate. Specific pertinent issues must be identified and discussed. For example, if a process uses an explosive chemical, a discussion of the special controls is essential.

Judges have frequently noted the following deficiencies in health, safety, and environmental issues:
1. Contestants know what laws apply, but fail to understand how those laws affect their project.
2. Many papers address federal regulations, but ignore state laws. Include both for your state.
3. Failure to discuss how regulatory approval will be achieved.
4. A lack of detail in plans for handling significant health and safety issues when processing at full scale.
5. Failure to select a viable technology due to inadequate familiarity with the hazardous materials and conditions of the project.
6. Lacks a well-rounded safety plan (i.e., physical, chemical, radiological, etc.) for the full-scale design.
7. A misunderstanding of the regulatory drivers; i.e., why a certain project may need to be completed or why some technologies are not viable.
8. Failure to address the special concerns outlined in the problem statement (health & safety, regulatory, economics, radioactivity, etc.).
• **Community Relations Plan**
A community relations plan is not required in every case. However, if your process will bring a hazardous operation to an area where none previously existed, or if cleaning up hazardous materials will create a public concern about the potential for a release, it is essential that you involve the community.

Listed separately below is the **Public Involvement Plan** that will help you learn how to engage the community in making decisions of public concern.

The most common errors in this section:
1. Telling the community what you plan to do versus letting them provide input to the decision.
2. Failure to explain why a community relations plan is not required, if that is the case.

• **Public Involvement Plan (a.k.a. Community Acceptance Plan)**
Projects conducted by federal agencies and the private sector must produce results that will directly benefit the surrounding communities at project sites. Involvement of tribal and public representatives in the evaluation of technologies can ensure that these projects will not only be improved as a result of such collaboration, but will gain community acceptance in the long term.

**Meaningful Partnerships**
Tribal and public representatives should participate in:
1. technology assessment,
2. development activities, and
3. deployment activities.

Although the public does not make final decisions, it is important that public representatives become partners in the decision-making process. Decisions developed through partnerships established early in the process will result in successful projects that will save dollars and other resources by solving problems early, before decisions become policy.

Meaningful approaches to creating decision-making partnerships require going beyond traditional public relations or community outreach activities and doing more than the regulations require.

**Objectives of the Public Involvement Plan**
Identify the public participation objectives. Some or all of these objectives should be considered:

- **Action Plan:** Create an action plan that includes local public involvement (including Native American and tribal participation in the project (where applicable)).
- **Decision Making:** Identify a clear definition of the decision-making process. A realistic expectation regarding all parties’ roles should be considered.
- **Information Requirements:** Analyze the types and forms of information for effective participation.
- **Education:** Develop an education element that addresses the needs of the group.
- **Accountability:** Establish a two-way accountability process. This should include an approach for responding to all input received. Actions taken should be documented. Integration of public involvement in the process should be defined.
- **Schedules:** Create schedules, milestones and time-lines for public involvement activities.
- **Resources and Costs:** Determine the resources required to implement the plan, including staffing and financial needs. Consider additional costs, such as travel and per diem.
• **Conclusions**
  The conclusions should be brief; they should state what you are going to do and why.
  The most common error: Reaching conclusions that are not supported by information in the body of the report.

• **Appendices**
  **Audits**—A paper received at the WERC office without the audit is incomplete.
  Ensure that your three auditors are qualified to review your paper based on the economic, legal, and health/safety issues, respectively. When possible, select auditors from the industry that would be utilizing your technology.
  • Give the auditors sufficient time to conduct their review.
  • Do not have anyone on your team, even advisors, perform the audits.
  • Ensure that the auditors write comments and make suggestions for improvement.

  Judges have often noted the following deficiencies with respect to the audit section of the reports:
  1. The most significant error: not using the input from the auditors to improve the paper or project.
  2. The professional who performed the audit did not read the problem statement.
  3. Auditors submit a form letter “rubber stamp.” This is not appropriate.
  4. The auditors are often professionals within the same areas of expertise. The auditors should come from as many disciplines as required for your project.
  5. Audits should not be performed by persons within the team’s university, as they do not have the same credibility as outside audits, due to conflict-of-interest issues.

  **Other items for Appendices**
  Appendices should be used very sparingly. Generally, only include information that is essential but is not appropriate in the body of the report; e.g., a letter quoting a price from a company willing to purchase either the product or the by-product from your process.

• **More Advice: Technical Writing**
  Judges frequently note the following deficiencies with respect to technical writing and editing:
  1. Spelling errors. Use the spelling checker.
  2. Failure to have the paper reviewed by a technical editor.
  3. Missing units and poorly defined quantities; e.g., 0.001 Kg versus 1 gm.
  4. Misuse of terms. Be sure that you know the correct definitions of industrial terms.
  5. Lack of figures, tables and illustrations. Properly used, they make a paper more readable. Figure captions should clearly explain all elements in the figure. The text should reference all figures.
  6. Poor use of figures, tables, and illustrations; i.e., they did not add to the clarity of the text.
  7. Incomplete process flow and mass balance sheets.
  8. Illegible graphics. Ensure that all graphics can be interpreted by someone who is not familiar with your project.

• **More Advice: Submit the Written Report on time**
  In the real world, late submissions are not considered. In the WERC Design contest, there is a heavy point-deduction for late paper submissions—such a reduction may cost you an award.

  Only the Team Leader or Advisor is able to upload the written report to the team’s account. If you have any problems with submission, please contact werc@nmsu.edu immediately or call 575-646-8171.
Hints for Preparing the Oral Presentation

The Oral Presentations:
1. Have your oral presentation ready two weeks before contest, minimum!
2. Show results and costs.
3. If you use something in the oral or in the poster presentation you didn’t in the paper, cite it. Know your sources well enough to be able to cite them at any time.
4. Pause frequently during the poster and oral presentations to let the judges process the information; well-planned pauses are effective in an oral presentation.
5. Practice presenting before various professionals, such as other faculty. Listen to their advice, and make corrections accordingly.
6. Try to relax before the presentation.
7. If you don’t remember something, pause.
8. Be prepared to answer questions about applications of the process; how to market it, who would use it ("the target audience"). If you were employed by someone in industry, this would be of critical interest.
9. If you don’t know the answer, don’t try to make one up or fake it...say you don’t know. You can follow it up with, “I don’t know, but think it might be ...”
10. Follow through on finding out the answers to judges’ questions at the oral presentation. You will have a chance to answer these during the bench scale/poster presentation.

Hints for Preparing the Bench-Scale Presentation

For the Bench Scale setup:
1. Be very careful with safety concerns, and make your setup stable and safe. You will be inspected by the NMSU Safety Officer as well as the WERC Contest Safety team.
2. Test your setup to check for leaks and stability.
3. Buy and bring your own goggles, rubber gloves, aprons or lab coats, etc. WERC will have goggles available but your own will probably look better.
4. Rinse the sample bottle before you put the treated water back in it, so there is no contaminated sample left behind to skew your results.
5. If you are shipping your equipment, pack it very carefully. Often items are broken if packed in a large container and not well padded.

The Bench Scale Demonstration:
1. Run the bench scale before you come, and analyze your results. These should be reported in the written report.
2. Check on the possibility of ordering a test kit to analyze your results to help you be independent of other labs to test your results.
3. Think like a scientist; if your first hypothesis does not prove correct, think, research, discuss solutions with your advisor, make another one and try again, and again, and again.
4. Be persistent; there is a solution that will work, but it may take time.
5. Keep it simple, if possible, because there are fewer things to go wrong.
6. At the contest, you will be able to set up your bench-scale demonstration on Sunday but it should not be operational until after the Safety Meeting on Sunday evening.
7. You will receive your samples (if your task requires a sample) on Monday. At that time, you may begin your process.
8. Your samples will be picked up no later than Tuesday afternoon. Check your schedule in the contest handbook for the exact time.
Hints for Preparing the Poster Presentation

Elements of the poster layout:
1. Your poster should include only the most important data, conclusions, and references—information you will need when discussing your process with the judges.
2. Graphics are the primary element of a good poster. Use them to illustrate your results (figures, tables, data, timelines, etc.).
3. Use bulleted lists or numbered lists for text. Do not include large blocks of text.
4. A poster should have plenty of “blank” space, and not look crowded.

Poster Presentation Strategies
1. The Poster Presentation is combined with the bench-scale demonstration: Both the poster and the bench-scale apparatus will be in your booth at the same time, and you may refer to either at any time when the judges visit your booth.
2. Judges will visit your booth in approximately three separate smaller groups. Learn from each group of judges at the poster/bench scale presentations, and incorporate what you learned into the next presentation.
3. Don’t memorize the poster presentation; perhaps the first intro, but not all.
4. Practice your presentation to every passerby who comes by the poster; you need the practice, and they may ask new questions you may need to consider.
5. Tell judges something new that was not in the formal oral presentation.
Hints for Preparing for the Flash Talks

Note that the Flash Talks are scored independently from the other stages of the contest, making it possible for a team to win first place in the Flash Talk Competition and not place in the main four-stage Design Contest.

1. The Flash Talk should effectively convince Rich Earth to invest in your technology. Although you are “selling” your product/process, remember that it is not enough to give a good sales pitch—make sure that you have engineering, cost, and scale-up data to back up your claims.

2. Engage the audience.
   a. Make eye contact with audience members all around the room. Take time to scan room: look at the audience to your left, center, and right (but do not let your eyes dart around too quickly). Do not turn your back on the audience.

3. Present a motivating introduction: What is this about? Why this is important? Attract people’s attention and make your audience care about your solution—Show how it makes an impact.

4. Build anticipation of your solution.

5. Structure your presentation to tell a story: ensure it has a strong beginning, middle, and end. Include stories that will engage the audience, if it doesn’t take you too far off track of your primary objectives.

6. Emphasize only one or two main points (do not try to throw all of the details at your audience).

7. Fit the talk to your own personality and style. Be who YOU are. Bring in humor, if it comes naturally.

8. You may use props (parts of your Bench-scale apparatus) if you wish.

9. Avoid distracting PowerPoint special effects.

10. Use graphics to tell your story: photos, tables, graphs (“A picture speaks a thousand words”).

11. Do not use long blocks of text; Use bullet points, do not write in complete sentences; make bullet points grammatically parallel. (It is easier for the audience to “digest” passages that are written in parallel with each other).

12. Carefully time your presentation. Practice over, and over again to ensure that you do not go over time.

13. Practice the introduction and the ending over and over until they flow naturally from you. That will get you off to a smooth start and ensure a strong finish.

14. Write a well-crafted closing statement: give a call to action, a strong summary of benefits, refer back to the original problem statement and describe how the problem can be solved using your technology, etc. Do not just close with a weak, “that’s all I’ve got.” Or “I’m out of time.”

15. Be ready to close at any point near the end of the talk, in case you are close to going over time. Have your final statement in your mind and practice jumping to it from different points near the end of the presentation. Trust us—sometimes the speaker will have an uncontrollable desire to add a “quick” unplanned thought that can shift the presentation off-schedule. Remember, any comments made after the bell will result in a point penalty.

16. We recommend that the closing remarks be timed and that a team member should cue the presenter when the closing remarks must begin, in order to finish within the allotted time.