

2021 TEAM MANUAL

Full Bench-Scale Demonstration Division

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.

Read the entire manual aloud as a team

to ensure that everyone understands all aspects of the contest.

2021 WERC Environmental Design Contest Team Manual

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PART I: POLICIES AND PROCEDURES

Full Bench-scale Contest Structure and Philosophy

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 Request for Proposal.

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

RFPs vary from company to company; thus, we have selected the facets of RFPs that provide effective ways for students to learn about the engineering design process. We list how each contest stage is modeled after the RFP:

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 and also teams to select 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 plan, and audits from professionals.
(*For the Design Contest, teams submit a written report containing these elements prior to the contest date.*)
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.
(*At 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 to confirm that the planned system is effective on a small scale. (*At the Design Contest, teams demonstrate their bench-scale models and WERC independently tests them.*)
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. The poster will be an important part of the discussion with the judges during the bench-scale demonstration. In 2021, teams may substitute the poster with a scholarly brochure, if it makes the bench-scale demonstration more convenient for the team.
6. ***Cash Awards:*** Winning a cash award is analogous to winning the engineering contract.

Contest entries should go beyond a simple science-fair-type display. Teams demonstrate their working bench-scale process, have their samples analytically tested in our own independent labs, and plan for full-scale implementation that considers cost, waste, schedule, feasibility, safety and regulations, public acceptance, etc.

Flash Talk Competition

The Flash Talk Competition is an additional, and separately scored, part of the contest. It helps schools fulfill ABET Student Outcome #3: Ability to communicate effectively with a range of audiences.

Judges for the Flash Talk Competition act independently from those who judge the 4-stage main competition. Cash awards for the Flash Talk Competition are awarded independently. Learn more about the [Flash Talk Competition](#).

Contact Information

- **werc@nmsu.edu** or **gscarbro@nmsu.edu**: Our email addresses. Please contact us if you have questions.
- **wercdesigncontest.nmsu.edu**: Our website. Here, find FAQs, published tasks, and general information.
- **werc.nmsu.edu**: The team management site (a.k.a. WERC team site). It is your connection to the contest for:
 - Registration and payment via credit card (note that Shopcart adds a 2.5% convenience fee)
 - Report submissions (Preliminary Report, ESP, Written Report)
 - Surveys (What did you like? How can we improve?)
 - Scores and judges' comments. View your scoring results after the contest.

Contest Overview

1. **One-hour Video Conference recording** helps first-time teams understand what judges are looking for:
<https://www.youtube.com/watch?v=IlnYq9oBH4>
2. **Specified Task vs the Open Task**. The five specified tasks are designed by engineering professionals to meet an immediate environmental need. The Open Task allows teams to choose their own topic; they are responsible for setting all parameters for their solution.
3. **The projects are student-run**—entirely organized, designed, and built by students, with faculty serving as mentors for the teams. Faculty advisors are expected to take a “hands-off” approach, but teams are welcome to consult with their advisors or other professionals as they develop their solutions.
4. **Questions about the contest or about a specific task**. The student Team Leader should contact us directly through the website “Contact Us” or at the email addresses listed above.
5. **Some teams start their research in the fall semester** and build their bench-scale models in early Spring. But most teams wait until Spring to begin the project.
6. **Timeline**
 - a. Before the official contest start date, 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 apparatus.
 - b. At the contest, teams will give Zoom presentations to environmental professionals (the judges):
 - i. Oral presentation with PowerPoint (45 minutes)
 - ii. Demonstration of the working bench-scale model (2 hours)
 - iii. Poster (or brochure) Presentation. In 2021, teams have the choice of preparing a poster or a brochure.
7. **Dates & Deadlines—Reports may be submitted as early as October 01, 2020.** (Check your task for specific dates.)
 - **December 14-17 or January 4-7**: Safety and Environmental Workshops. Attendance is not mandatory, but will give teams a competitive edge. Judges say technical reports are often weak in these areas.
 - **February: Preliminary Report**. Required of the Open Task and may be required of Tasks 1-5 (see Task Problem Statement for report requirements. The report helps teams to confirm that they are heading on a path to success. Technical experts will review the report and suggest changes, if needed.
 - **For the Open Task**, the Preliminary Report includes a detailed description of the bench-scale apparatus as well as specific analytical testing needed for WERC to test your design at the contest.
 - **February: ESP (Experimental Safety Plan)**. Not required in 2021. Follow your institution’s safety protocols for all laboratory work.
 - **March 29: Written Report due**. Required of ALL participants.
 - **April 5-6: Bench-scale demonstrations** for Tasks 1, 3, 5, and possibly 6 (depending on the project).
 - **April 10: Submit team video** to be shown at the Opening Ceremony (may be moved to Awards Ceremony).
 - **April 11-14**: Attend the contest via Zoom and enjoy showcasing your work!
 - **April 11: Opening Ceremony. Submit Flash Talk Slides.**
 - **April 12: Oral Presentations** via Zoom in morning. **Flash Talks** in evening.
 - **April 13: Bench-scale Discussions** via Zoom
 - **April 14: Awards Ceremony**

8. Registration:

- a. Registration opens in early November and is handled online through werc.nmsu.edu.
- b. A faculty advisor sets up the teams, all students register, and the advisor pays the registration fee. The fee covers less than 1/4 of our costs, but it helps us tremendously.
- c. Early-registration discounts and multiple-team discounts are offered to all teams.
- d. Registration fees will not be refunded, except for unavoidable circumstances. In that case, the team will be charged their part of expenses incurred at the point they exit the contest. For example, if WERC has already ordered synthetic solution for your task, the cost of materials will be subtracted from the fees you paid.

9. 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 appreciate the teams' innovations and forward thinking.
- b. A group of 4-6 judges score each written report before the team arrives at the contest. Scores are tabulated on the WERC team management site (werc.nmsu.edu). Each team will meet with the same group of judges throughout every event of the contest, allowing teams and judges to get to know each other. The same group of judges will evaluate all teams within a given task.
- c. 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.
- d. On Tuesday, judges visit the bench-scale demonstrations 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. Teams have the chance to show their model to the judges and discuss the rationale behind each aspect of the design. Judges take the time to discuss the team's poster and delve more deeply into each team's design, and students are given the chance to answer questions they were not able to answer during their oral presentation. Students say this is their favorite part of the competition because they feel they are treated as peers by the judges, instead of being "judged."
- e. On Wednesday morning, judges convene to determine the awards in each category.

10. Team logistics

- a. Teams provide their own Zoom video and audio during each contest event.
 - i. During the Oral Presentation, team members will log in from separate computers
 - ii. During the Bench-scale Demonstration, team members will adhere to their school's health and safety protocols while demonstrating their apparatus.
- b. A local engineer (arranged by WERC) will supervise the bench-scale demonstration and will:
 - i. Bring the synthetic testing solution to your team's lab
 - ii. Watch the bench-scale demonstration and collect resulting samples.
 - iii. Package the samples and ship them to the appropriate labs for analytical testing.

11. SWAG and Trophies:

- a. Be sure to enter your sizing information when you register at werc.nmsu.edu. We will be shipping SWAG to all teams.
- b. After the contest, trophies will be shipped to the winning teams.

Scheduling and Zoom Links

All times and links will be emailed to the teams by the WERC staff. Scheduling is based on judges' availability. If your team has specific time constraints, **kindly notify us by January 31.**

No team will be scheduled earlier than 8:30 AM for their time zone.

1. NMSU is capable of multi-point Zoom conferencing to accommodate separate sign-ins for each team member.
2. The WERC staff will email to Team Leaders and Faculty Advisors:
 - a. Each team's 45-minute Oral Presentation time slot and one Zoom link for that session.
 - b. Each team's 2-hour Bench-scale Discussion time slot and one Zoom link for that session.
3. Team Leaders and/or Advisors will notify all team members of assigned session times and Zoom links.
4. One Zoom link will be provided for all participants to attend the Welcome Ceremony and the Awards Ceremony.

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 \$25,000 in cash prizes.

Successful completion of every stage of the design project qualifies teams for the following awards.

1. Task awards (First Place \$2500, Second Place \$1000, Third Place \$500; minimum amounts).
2. The Flash Talk awards (First Place: \$1000, Second Place \$750, Third Place \$500, Audience Favorite \$250).
3. WERC Resources Center Pollution Prevention/Energy Efficiency Award (P2/E2 Award) (\$500)
4. Judges' Choice Award (\$500)
5. Peer Award (Tentative) (\$250) (Teams vote on their favorite designs).
6. Terry McManus Outstanding Student Award. (\$500-\$1000, according to funding). Faculty nominate a student from their team. See [Award Selection Criteria](#) for nomination details. Up to 3 students may win.
7. Additional awards may be announced at a later date.

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: 27 pages, including report cover, title page, table of contents, executive summary, report body, figures, tables, and references. The audits are not included in the page count.
- Use the [IEEE template](#) found on the WERC website Guidelines page to prepare your manuscript.

Required Elements of the Written Report

1. The paper must include (all included in the page count, except for the audits):

- A report cover identifying the school and task
- A title page with school, team number, task, advisor, and team member names
- A table of contents
- An executive summary (maximum of two pages) highlighting the proposed solution (see #2, below)
- The report body (see #3, below)
- Figures, illustrations, photographs, and graphs
- References
- Audits (see #4, below) – Not included in the page count.

2. Executive Summary

- Judges use the Executive Summary as a reference. It 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.

3. The body of the paper must include (See PART II for full discussions of these sections):

- Background research
- Description of your team's solution
- Detailed process-flow diagrams with mass and energy balances. Include input and output rates, reactants, and reaction rates, etc., as applicable. (Judges have specific expectations—See Part II for an [example](#)).
- Test data
- Technical evaluation of the performance of your team's solution.
- Bench-scale/prototype lab results
- Full-scale design description, calculations, CAPEX and OPEX, and implementation schedule.
- Address all wastes, including the fate of all waste products, generated by the process
- Business Plan
- Health, Safety, and Environmental regulations (attend the required Safety/Regulations Short Course that helps you prepare this section of the report while meeting ABET Student Outcome #2)
- Community Relations/Acceptance Plan (your team's recommendations to encourage public acceptance)
- Conclusions

4. Audits: Teams are required to include three separate audits. The three audits:

- address each of the topics: 1) Economics, 2) Health Issues, 3) Legal Issues
- are conducted by professionals involved in each specific field. Suggested auditors: faculty members, industrial representatives, experts, doctoral students, etc.
- are not edited copies of your paper. They are the auditors' evaluation of one aspect of your report.
- should not exceed 2 pages and will not be counted toward your page count.

5. 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 student team leaders have access to upload the report.
- Deadline for Written Report: **11:59 PM, March 29, 2021** (your time zone)
- Late reports will be penalized by 25 points per day.
- Re-submitting your report will replace the previous version and update the time stamp.
- Use caution if re-submitting after the deadline, as this will affect the late penalty.

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.
- Thorough mass balances and process flow diagrams (PFD) (include input and output rates, reactants, and reaction rates, etc., as applicable) See Part II for an [example of an acceptable PFD](#).
- 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 and public involvement plan.
- Overall quality: grammar, organization, succinctness.
- Late Submission deduction (25 points per day late)

WERC IEEE Conference Proceedings

The WERC Environmental Design Contest is an IEEE conference. All technical reports that the judges consider to be of sufficient technical merit and acceptable quality will be published in WERC's 2021 IEEE *Xplore* Conference Proceedings. The reports will be abbreviated versions of the original technical reports and will undergo a second review/revision process that may take up to two months after the contest ends.

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. All members of the team and their Faculty Advisor and Co-Advisors, if any, may be listed as authors of the paper.

If your team is invited to submit a paper for the conference proceedings, we will email additional instructions to the Advisors and Team Leader after the contest. As with most conference proceedings, IEEE charges a per-paper fee for publication in the proceedings. WERC will cover the charges.

Submission to IEEE *Xplore* requires the authors to provide a transfer of copyright, as IEEE will be the copyright holder of the published papers.

IEEE Xplore Publication Fees

IEEE charges WERC to publish in *Xplore*. All teams that publish a paper in the proceedings will be charged a \$50 fee. The fee will be waived if at least one member of the team is a member of IEEE.

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.

Oral Presentation Guidelines and Judging Criteria

Regulations and Logistics

1. **Total Zoom Time Slot:** 45 minutes allotted as:
 - a. 5 minutes—Team members log in, confirm proper video and audio connections and set up slides
 - b. 16 minutes—Oral Presentation. 15 minutes for content + one minute for presentation transitions.
 - c. 10 minutes—Questions/Answers with judges. If possible, there will be more than 10 minutes of Q/A
 - d. 9 + 5 minutes—Time for potential technical delays.
 - e. 5 minutes—Time for judges to transition to the next team.
2. **Technical difficulties.** If technical difficulties prevent a team from presenting at their scheduled time, judges will re-schedule the presentation for a time later in the day.
3. **On camera.** Both the presenter and the slides should be displayed at all times during the presentation. All team members should turn on their cameras, if possible. Conduct transitions in a professional manner.
4. **Type size.** Type on the slides should be readable on small computer screens (no smaller than 14-16 points).
5. **Zoom:** Use a Zoom background photo containing the team name and school logo, if possible.
6. **Presenters:** A maximum of four team members may present. Only these four may answer judges' questions. Violation of this rule will result in a 25-point deduction.
7. **Goal:** Convince your client (a.k.a. the judges) that yours is the optimal solution for the task.
8. **Intended Audience for the presentation:** Judges who, acting as your client or plant manager, will decide if your designs are technically, logistically, and economically viable.
9. **Secondary Audience:** Other students from your school may attend, but must remain silent and turn video off. Although faculty advisors are allowed, judges prefer that they not attend, as their presence can hamper the students' presentations. Competing teams are not allowed in the session.
10. **Introductions/Conclusions:** First, the team leader introduces the team members. The presentation ends with a discussion of conclusions. Next, the team leader asks the audience if they have questions. Develop a system for quickly determining which team member will answer a particular question.
11. **Point deductions:** 25 points deducted: a) per minute over the presentation time limit. b) if a faculty advisor attempts to give a part of the presentation or answer judges' questions c) too many presenters.

Preparation:

1. Dress in business attire (Dress for Success!)
2. Prepare a confident, technical and business-like discussion of your solution.
3. Do not read off of the slides. Use them only to remind you of the next topic. This is tricky when presenting via Zoom, but try to talk directly to the judges by looking into your camera, not at the slides).
4. Include all essential elements from the body of the written report (See page 7).
5. Include citations at the bottom of each slide.
6. Use graphs, charts and figures to illustrate trends and report findings.
7. Be concise. The judges have already read the report. Make the most important points.
8. 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 discussions on the following day.

Oral Presentation 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 teams. Many judges volunteer their time because of the satisfaction they receive in interacting with the students. Have fun!

Regulations and Logistics

1. **Safety at the contest**

- a. **The Experimental Safety Plan** is not required this year since you will not be running your bench-scale demonstration in Las Cruces.
- b. **Follow your institution's safety protocol** for running all experiments. Provide protective safety gear for the judge that will come into your lab, as needed (goggles, lab coat, gloves, etc.)
- c. **Judging:** Judges consider your team's: wearing of personal protective equipment, ability to identify potential hazards, and implementation of safety protocols when they Zoom in to your demonstration.

2. **Bench-scale demonstration and sample testing***

- a. **For Task 1, Task 3, and Task 5 (and possibly 6):** Your bench-scale demonstration will be tested at your institution on April 5. This is one week prior to the oral presentation. On Monday, your on-site judge will hand your team a pre-mixed solution (chemical composition listed in your Task Problem Statement). Samples for Tasks 1 and 5 will be collected on Monday, April 5. The Task 3 reactor will run until 2:00 pm the following day (April 6).

The judge will collect your resulting solution, seal it, and ship it to the appropriate analytical lab for component evaluation. Lab results will be reported to judges as soon as they are available.

- b. **For Task 2:** Teams will ship their device to San Francisco to arrive on April 11, 2021 (Watch FAQs and WERC team site—date may change). Teams may remotely observe the device testing.
- c. **For Task 4:** If possible, teams will ship their product by Monday March 5, you will ship samples of your finished product to each of the judges. On Monday, April 11, your team will demonstrate (via Zoom, with the help of your on-site judge) the process used to create the finished product.

*As we get nearer to contest dates, minor adjustments may be made to these schedules.

3. **Bench-scale Discussion: Held on Tuesday, April 13 for all tasks.** Teams like to meet with judges one more time after their Oral Presentation. This gives them a chance to answer questions that they could not answer during the Orals and gain more insight from the judges for putting their plans into practice.

Although Tasks 1, 3, 5, and 6, conducted their bench-scale demonstration one week prior to the contest, they will still engage in the bench-scale discussion on Tuesday, April 13 to allow teams to meet with judges to address previously unresolved questions from the Oral Presentation.

4. **Bench-scale Judging:** Judges (usually 4-6 people) come to your Zoom breakout room in three 45-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. Refer to your poster or brochure during this session.

5. **Visitors:** We usually invite the Las Cruces community, including students, to attend the bench-scale demonstrations, but with the online format, this will probably not be possible.

6. **Team meets team:** We will schedule a time for you to visit other teams' bench-scale demonstrations. This is a great time to learn how they approached the same problem. You may also visit a team that worked on a different problem than you did. More details to come.

Bench-Scale Demonstration Judging Criteria

- Originality, craftsmanship, and suitability of the bench scale construction.
- Effectiveness, functionality, yield, and overall performance of the apparatus.
- 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/Brochure Specifications

1. Teams may choose whether they will prepare a full-size conference posterboard or a folded brochure. When deciding which to use, select the most convenient format for your team. Consider that you will be referring to it during the bench-scale demonstration. Either should be designed to present information in a scholarly manner.
2. Posterboard (printed and displayed in your lab during the bench-scale demonstration):
 - a. Only one poster board will be created for each task.
 - b. Maximum size: 48" X 48".
 - c. The cost for the preparation of poster displays 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.
 - d. The poster presentation will be scored at the same time as bench-scale presentation.
3. Brochure (pdf format uploaded through the team site [werc.nmsu.edu]):
 - a. 8 ½" x 11" (letter size)
 - b. One- or two-sided (team's choice)
 - c. Margins: Minimum 0.375"
 - d. Minimum type size: 12 points
 - e. Bifold or trifold (team's choice)
 - f. Place a thin line along the fold lines to guide folding.

Poster/Brochure 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 about the poster/brochure

Experimental Safety Plan (ESP)

The ESP is not required in 2021 because teams will be demonstrating their designs in their own labs.

Refer to your institution's safety protocols, but remember that judges may look for or ask you about:

- 1) Appropriate Personal Protective Equipment (PPE)
- 2) Safety Data Sheets for all chemicals/materials used
- 3) Normal Operation, Startup and Shut-down Procedures
- 4) Emergency Shutdown Procedures
- 5) Waste Management Procedure
- 6) Hazard Identification and Mitigation

For your safety, please make sure no researcher works alone in a lab at any time.

Preliminary Report Guidelines—For specific tasks only

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. Do not turn it into a lengthy essay—Help the reviewers quickly find the information they need. Happy reviewers will spend more time giving you helpful tips!

Open Task Test Plan Guidelines – For Open Task participants only

The Test Plan is submitted online through the WERC team site. It is due February 25, 2021 (at the latest) to allow us time to contact you with additional questions or comments. Please try to submit it earlier, if possible. Purpose: to help our staff prepare to test your design.

Our Analytical Testing Officer and our Safety Officer will evaluate your plan and suggest modifications, if needed. If you have questions about specific requirements for your problem statement, please contact us.

Include these items in your Open Task Test Plan:

1. **Problem Statement** (What is the problem? 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).
3. **Chemicals Used/Materials:** Provide a numbered list of all chemicals, materials, and equipment needed for your solution (you are allowed to change these as you learn more about your project).
4. **Synthetic solutions needed.** If you need to begin with a synthetic solution, WERC needs to prepare it for you and ship it to your attending judge. List chemical components of any such solutions.
5. **Testing methods** that WERC will need to arrange to show success with your process. If chemical analyses are needed, list each specific chemical analysis that is needed to demonstrate success; If your team is demonstrating a non-chemical process, indicate all measurements that our labs need to make to confirm your team's success in solving the problem.
6. **Additional items.** Above is the minimum required for the Test Plan. Your specific task may require that you submit more information. Submit early, if possible, to give us time to request additional information.

Team Video Guidelines—Celebrate your team!

Create a team video that represents your work, your struggles, and your joys. Have fun and let it reflect your team spirit, creativity, and sense of humor. The video may include still shots or video. Please keep it clean.

Feature your report title and school name/logo near the beginning of the video (more often, if desired); include names with images of all team members (and advisors, if you wish) somewhere along the way. It should be clear what is happening in each scene of the video. For example, if you take on-location shots, make it clear what the images depict (either use dialogue, voiceovers, or add text to the images).

Submit: via Dropbox folder (link TBA)

Video length: no longer than 1.25 minutes

Submission deadline: April 9, 11:59 PM (MDT)

Formats: mov, mp4, MPEG, AVI, AVCHD

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-scale demonstration, and poster presentation) and also has appropriate bench-scale results.

The number of awards depends on the number of entries per task. We apply the one-half rule: No more than half of the entries will receive awards. 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-, and Third-place awards, etc.

In the event that only one team enters a task category, that team will be consolidated with other tasks, according to the closest fit, for judging purposes. As is true with every scoring decision, each team will be judged on the merits of sound engineering judgement and the ability to express this to the judges, independent of the topic of their research. Note that the same judging principle is applied each year to the Open Task. It has a minimum of three completely different tasks competing for the same prizes.

Judges' Choice Awards (\$500+)

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

Peer Award (\$250)

If it can be arranged via Zoom, teams will visit other team's bench-scale demonstrations/discussions and vote on the best solutions to current environmental issues. A team cannot vote within their own task.

Pollution Prevention/Energy Efficiency Award (\$500)

Specific criteria for this award are listed in each task problem statement. The P2/E2 award is 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.

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 one-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.

Nomination letters should be submitted to the WERC team site by the first day of the contest.

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.

Participation: Participation in the Flash Talk Competition is optional.

Registration: Register your intent to participate in the Flash Talk Competition by emailing werc@nmsu.edu.

Cash Awards: First \$1000; Second \$500; Third \$250; Audience Favorite \$200.

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 other invited guests. WERC will invite members of local environmental groups and students from New Mexico high schools.

Judges

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

For this presentation, eliminate all jargon. 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.

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—Innovations. Present the innovations that make your solution superior to previous/alternative technology; If you have preliminary bench-scale results, present them here. If you are conducting a desktop study, no preliminary results are needed;
- 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, a challenge, or a success report.

Flash Talk 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 “Flash Talks”).
- **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 Sunday, April 11 by 11:59 PM (MST)**.
- **How to submit slides:** Instructions will be sent to those who register to compete.
- **Contest slideshow:** To save transition time, all slides will be combined into a single PowerPoint presentation and advanced by a Zoom moderator. The presenter will say, “Next” to have the next slide advanced.
- **Slide Format:**
 - Type: minimum of 20 points.
 - Allow a 1” margin on all sides of the slide (excluding footnotes or repeating required bottom matter).
 - 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.
 - On every slide: unobtrusively place team name, school logo (optional), and brief project title. Point size may be smaller than 20 points.
 - Slides may contain simple animations and may contain video: one video counts as one slide.
 - All animations and video must be easy to enable by the Zoom moderator.
- **Dress:** Teams are expected to dress in a professional manner.
- **Zoom:** Use a Zoom background photo containing the team name and school logo, if possible.
- **Presenter(s):** We recommend that only one person present the Flash Talk. More are allowed, but due to time constraints, we recommend no more than two.
- **Team members** who are not speaking should log in and keep their camera turned on. When your team is finished presenting, please turn your cameras off.
- **Timing:** The clock begins to run as soon as the presenter begins speaking. 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.

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
- Effective use of the Zoom presentation format

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.
 - c. Some teams place students on a team as sophomores, and each year these students are given increasing responsibility: becoming a Team Leader in the Junior year and a Co-Advisor in the Senior year. Ask your advisor about adopting this model in the future.
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.

Contest in general:

1. Dress to impress; look, act, and dress as professionals in your field.
2. Have your team set up a realistic timeline and follow it.
3. Take time to network while at the contest. Talk to people and ask for business cards/contact info, whether they are students or judges or local college students. This can be done at the virtual contest as well.
4. Don’t just sell your process, sell yourselves.
5. Bring extra copies of your paper with contact information, in case judges want to recruit you. At the virtual contest, have a pdf ready to email to someone who is interested.
6. Bring your resume. If you are not graduating, there may be internships available. If you are graduating, there may be a job available. At the virtual contest, have a pdf of your resume ready to share.
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 a personal business card for yourself containing contact information and keep it handy to share.
9. Your team may benefit from tracking the hours spent on different areas of concern: research, testing, writing, etc. You can pass this along to future teams at your school to help them as well.
10. The first year of participation is the toughest because teams do not know what to expect. Keep entering every year and, during the “off season” ask our judges for help preparing. They are happy to help you learn!

Know the Task Problem Statement and Manual Contents:

1. Near the beginning of your preparation, read the entire manual aloud as a team to ensure that everyone understands all aspects of the contest.
2. Carefully read and discuss the Task Problem Statement aloud as a team at least once per week during early stages. Later on, review it aloud periodically. Make checklists to remember all requirements.

Organization:

1. Keep a tabbed binder in the lab that is accessible at all times containing: Task Problem Statement, Team Manual, Judging Criteria, FAQs, and Deadlines.
2. Ensure that everyone on the team reads all material.
3. Assign a team member to check the website weekly. Especially the FAQs.
4. Make check lists for everything: 1) judging criteria, 2) requirements, 3) equipment to pack, etc.
5. Stay organized; have one person organize all research information logically and accessibly.
6. 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 come from minor points mentioned in papers.
2. Contact a mentor with expertise in the area early and often; he or she may help you gain insight and help you find research papers and other reference material.
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.
3. Presenting a weak Process Flow Diagram (PFD).

These issues will be prevented by discussing the problem statement with the entire team and your mentor(s) and referring to our [sample PFD](#) (see below).

Travel (not needed in 2021):

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.

Follow-up:

After the competition:

- Write down what you have learned and pass it down to next year's teams at your school.
- Write thank-you notes to your task's sponsors. They will be impressed by your efforts and more likely to want to sponsor the contest next year.

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 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. That is not desirable. Spend most of the 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. Process flow diagrams that lack appropriate mass and energy balances. ([See examples below.](#)) If your team is unsure that they have met all requirements, you may submit your PFD for preliminary approval.
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 processes. 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.

- **Sample Process Flow Diagrams that include Mass and Energy balances (as applicable)**

Your PFD should show every process stream in your design.

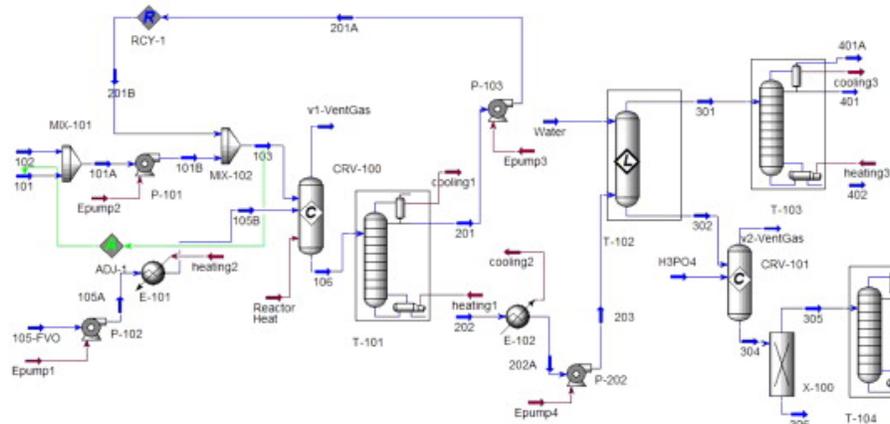
Alongside the PFD you must include a table that includes the following, as they apply to your design:

- Normal operating temperature and pressure.
- Normal volumetric or mass flowrate. If multiple phases are involved, report flowrate for each phase.
- Density at normal operating temperature and pressure conditions. If the stream has multiple phases, density for every phase should be reported along with the overall density.
- Viscosity for each phase in the stream should be separately reported.
- If gases are present, vapor fraction should be reported.
- Specific heat ratio Cp/Cv and compressibility factor should be reported for gaseous phase.
- Molecular weight for each should be reported separately.
- Enthalpy flow for each stream is also reported sometimes in KJ/hr.

Be sure to:

- Define all abbreviations
- Clearly label all streams. To help the judges quickly scan your PFD, we prefer that you use a descriptive label (such as “Distillation Column”) rather than difficult-to-decipher coded labels.

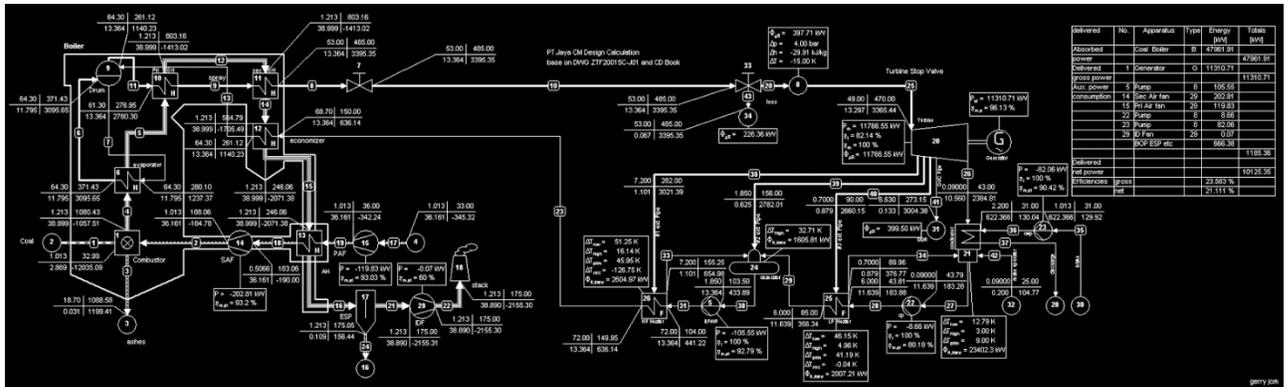
A sample PFD is shown below, the general layout is good, though we prefer that you add descriptive labels to each stream, rather than numbered codes.



Stream name	101	105-FVO	103	106	201	202	301	401	305	502
Pressure (kPa)	101.3	101.3	400.0	400.0	20.00	30.00	110.0	10.00	101.3	30.00
Temperature (°C)	25.00	25.00	26.69	60.00	28.20	142.8	59.39	70.97	163.1	180.0
Molar flow (gmol/hr)	17644	5929	36880	42810	17390	24880	17640	17150	6534	5743
Mass flow (kg/hr)	565.3	5250	1192	6442	574.4	5868	5284	4999	533.7	518.6
Volumetric flow (m ³ /hr)	0.7192	5.770	1.510	7.007	0.7340	48.70	6.205	5.968	4.943	0.5214
Component mass fraction										
Methanol	1.000	0.000	0.956	0.093	1.000	0.004	0.001	0.001	0.004	0.000
TGA triolein	0.000	1.000	0.000	0.041	0.000	0.045	0.050	0.002	0.000	0.000
Methyl oleate	0.000	0.000	0.000	0.778	0.000	0.854	0.948	0.996	0.000	0.000
Glycerol	0.000	0.000	0.000	0.080	0.000	0.088	0.000	0.000	0.967	0.995
NaOH	0.000	0.000	0.044	0.008	0.000	0.009	0.000	0.000	0.000	0.000
H ₃ PO ₄	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H ₂ O	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.029	0.005
Na ₂ PO ₄	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Soojin Lee, Dusko Posarac, Naoko Ellis, Process simulation and economic analysis of biodiesel production processes using fresh and waste vegetable oil and supercritical methanol, Chemical Engineering Research and Design, Volume 89, Issue 12, 2011, pp. 2626-264.

Alternatively, values can be placed directly on the diagram:



<http://aerryawan.blogspot.com/2016/01/heat-and-mass-balance.html> (accessed 1/06/2021)

- **Diagrams for Non-Chemical Designs, such as Sensors**
 - Follow protocols for your discipline.
 - Designs involving sensors should include schematic diagrams and technical specifications for the device and each sensor as well as data flow diagrams for the sensors and data logger (if applicable).

- **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 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 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. Consider some or all of these objectives:

- **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 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. Figures should 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, ensuring that your setup is stable and safe. Judges will note safety hazards. If testing in Las Cruces, you will be inspected by the NMSU Safety Officer and 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. If competing in Las Cruces, 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 competing in Las Cruces and 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. If competing in Las Cruces, 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) when your assigned judge arrives at your laboratory. As soon as your judges have logged in, you may begin your process.
8. Your judge will pack and ship your resulting samples to a laboratory for analysis approximately one week prior to the official contest start date.

Hints for Preparing the Poster/Brochure Presentation

Most teams will be conducting in-lab Bench-Scale Demonstrations one week prior to the official contest start date. On Tuesday of the contest (April 13), all teams will participate in the Bench-scale Discussions. Be sure to have your poster/brochure available for both of these sessions.

Elements of the poster layout:

1. Your poster (or brochure, if you prefer) 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. Use full sentences only when absolutely necessary.
4. A poster or brochure should have plenty of “blank” space, and not look crowded.

Poster Presentation Strategies

1. The Poster Presentation is combined with the bench-scale demonstration: Have the poster handy to refer to during the demonstration. If, instead, you choose to use a brochure, you will upload a pdf of the brochure to the WERC team site and refer to numbered sections of the brochure during the bench-scale demonstration.
2. Judges will visit your Zoom breakout room in 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 of it. Be prepared to address what interests the judges.
4. Practice your presentation often. Invite family to Zoom in on your practice sessions; 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 a company 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 (look into the camera and not at your slides).
 - b. Be interesting. Vary your vocal tone and inflections. Brighten your eyes. Be excited about your solution.
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.