2020 Experimental Safety Plan (ESP) Instructions

**General Instructions**

*An Experiment Safety Plan (ESP) is required for every experiment conducted and performed by students in the WERC Design Contest. The purpose of the ESP is to assure the safety of all by identifying the safest possible methods to conduct an experiment. By signing below the individual(s) conducting the experiment, College of Engineering Safety Specialist (COE Safety), and the faculty advisor acknowledge responsibility for the following requirements.*

1. *Appropriate Personal Protective Equipment (PPE)* ***must always*** *be worn while in the Benchscale lab area (as described in the ESP).* ***The minimum required PPE is (1) long pants, (2) closed toe shoes, (3) lab coat or long sleeve shirt, and (4) safety glasses with side shields.***
2. *For safety reasons, no researcher is permitted to work alone in the benchscale lab area at any time.*
3. *ESP approval occurs in two phases.*
   1. *Phase I is the preparation of a written safety plan includes an evaluation by COE Safety (and if appropriate by EH&S) to establish controls of hazardous operations, avoid the purchase of inappropriate supplies, and establish expected waste(s) streams. Upon approval of the written plan, from COE Safety, the team is approved to bring their experiments, equipment and necessary chemicals to the WERC Design Contest.*
   2. *Phase II approval will occur onsite at the event and requires evaluation of the assembled experiment.. Upon approval, the team will receive theirsynthetic water solution or other task related materials and can begin operation of their experiments.*

**Experimental Scope:***Provide a concise description of the benchscale laboratory experiment to be undertaken.*

1. *Explain how and why the work is being performed, the goal(s) of the experimental program*
   1. *If this is an update/revision of previous ESP describe all changes*
2. *If a chemical reaction is occurring, intentionally, then provide the stoichiometry of any chemical reactions and their heats of reaction. If no intentional chemical reactions then list this as Not Applicable*
3. *If a chemical reaction is occurring intentionally, then calculate the inherent thermal safety of your experiment If no intentional chemical reactions then list this as Not Applicable   
     
   The link below should help with this calcuation*<https://chme.nmsu.edu/research/ehs/experimental-safety-plan-esp/esp-energetics-calculation/> *)*
4. *Include a complete list of all chemicals and materials involved in this experiment. Also include household chemicals such as bleach, vinegar, ammonia, table salt, baking soda etc. If you are using glue, silicone, paint etc. be sure to include those. Materials used for construction of your experiment such as wood, pvc pipe, tubing, insulation etc. needs to be listed here. Include a complete list of all equipment such as centrifuge, pumps, heat baths, stirring mechanisms, filters, reservoirs etc. involved in this experiment.*
5. *Include a timeline for this experiment including setup, sample runtime(s)and teardown. Explain any requests for after-hours running of experiments. Will the equipment operate autonomously or monitored remotely or will it need to be monitored by someone onsite?*

SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB  
  
**1. Experiment Summary**

**2. Balanced Chemical Reaction(s) or state that this is not applicable and why.**

**3. Thermal Safety of Chemical Reaction(s) or state that this is not applicable and why.  
4. List of All Chemicals and Materials planned for this Experiment as described previously.  
5. Experiment Timeline including Setup, Sample Running and Teardown. Be sure to include any after-hours runtime requests.**

**Drawing of Experimental Layout including P&ID***Provide a detailed drawing of the experiment using a flow diagram that shows all inputs and outputs for equipment and system. This is required for all ESPs regardless of complexity and something basic is acceptable.*

*SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB*

* + 1. *Attach flow diagram for experiment in pdf format.*

**Normal Operation, Startup and Shut-down Procedures:**

*Provide a* ***step-wise*** *procedure that describes* ***in detail*** *how the work will be performed. The procedure should begin and end with the equipment in the normal idle (inoperative) state.*

*Include a statement of the required PPE (Personal Protective Equipment)* ***at the beginning*** *of the procedure, and at every location in the procedure where the PPE requirements change.*

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

*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.*

*Take into account those items for which you indicate “yes” on the WERC Lab Hazard Assessment Checklist (See the Attachment Tab).*

*SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB  
  
1. PPE Required (safety glasses, gloves, lab coat, shoe covers, etc.)  
2. Detailed stepwise process & flow procedure for the entire experiment  
3. Run time and/or run rate and description of other Task specific requirements  
4. Describe how any hazardous materials will be stored and used.*

***E*mergency Shutdown Procedures:**  
*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, fire in your equipment, fire in the surrounding benchscale lab area, etc. The description should include a detailed explanation of how to attend to potential medical emergencies (e.g. first aid) that may result*

*SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB*

1. *Describe in detail how you will shut down your experiment in case of an emergency.*

**Waste Management Procedure:**

*Prepare a Waste Management Procedure that provides the exact nature and estimated volumes of all wastes to be generated in performing these experiments. NMSU will provide containers and forms to be filled out by the researcher for proper disposal of materials. (See the Attachment Tab for examples of the NMSU Waste Tracking Form, NMSU Waste Sticker and photos of containers.)   
  
SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB  
1. Describe in detail what wastes will be generated and what state they will be (e.g. solid, liquid, slurry, etc.)  
2. Describe the waste compatibility and needs for segregation.*

**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 Attachment Tab).   
  
The 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*
* *When in doubt about whether something represents a HIGH HAZARD, ask COE Safety for a determination*

*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.*

SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB  
*1. Describe the actions you plan to take to address items marked “yes” on the WERC Lab Hazard Assessment Checklist*

1. *Describe any hazards not addressed on the checklist that you feel are important to safety.*
2. *Describe any PPE beyond the minimum needed.*
3. *Describe any special training and/or precautions needed for visitors to your booth at the WERC event (e.g. UV safety glasses)*

***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 make them available, but you have to tell us what you need. Examples include balances, electrical test meters, hand tools, secondary containment vessels (e.g. kiddie wading pool), easels, stands, brackets, clamps etc.   
  
SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB*

1. *List and details of any equipment you require that will not, or cannot, be shipped to the event*
2. *List how you want to provide secondary containment for your experiment if using liquids.*

***Safety Data Sheets***

*Provide SDS documents for all chemicals used at the event including household and consumer products  
  
SUB-DROP DOWNS TO ADD AFTER THE MAIN TAB*

1. *Attach all Safety Data Sheet (SDS) documents in* ***pdf*** *format*