ESP# _____

Team # _____

Rev ___

Experiment Safety Plan

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 lab (as described in the ESP). **The minimum required PPE to enter a research/teaching lab 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 lab at any time. If you plan to work during a time when the lab might be expected to be empty, please plan ahead and coordinate your work schedule with another lab member.

3) ESP approval occurs in two phases.

   a. Phase I is the preparation of a written safety plan. Upon approval of the written plan, by email from COE Safety, researcher(s) may order equipment and necessary supplies, and assemble experiment for transport to NMSU. Phase I also 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.

   b. Phase II approval will occur onsite at the event and requires evaluation of the assembled experiment, showing the basic experimental procedure. . High Hazard work may be subject to approval by official university boards, including any work with radioactive materials or radiation producing machines, certain biological materials, animals and/or human subjects.

		Date
ESP Phase I approval: **COE Safety**		
ESP Phase II approval **COE Safety**		

4) By signing below, both faculty advisor and researchers(s) understand that COE Safety can approve/disapprove any part of the ESP. It is the goal of COE Safety to help the researcher(s) find the safest method(s) of conducting an experiment. COE Safety, or any faculty member, may stop lab activity of individuals not following good lab practices.

	Name	Signature	Date
School Name		NA	NA
Team Number – Assigned by WERC			

Faculty Advisor			
Researcher			
Researcher			
Researcher			
Researcher			
Researcher			
Researcher			
Researcher			
Researcher			
EH&S (at request of COE Safety)			

NMSU WERC Environmental Design Contest Experimental Safety Plan (ESP)

This document must be typed.

Task # (Assigned by WERC)			
Name/Title of Experiment:			
Contacts (Required for Team):	Name	Cell Phone	Email
Serious Issue	Emergency	911	na
Safety Coordinator	Juanita Miller	575-415-7999	miljgh@nmsu.edu
Faculty Advisor			
Responsible Researcher			
Responsible Researcher			

Required attachments to the ESP:

Attachment 1: Experiment Scope

Attachment 2: Drawing of the Experimental Layout including P&ID

Attachment 3: Normal Operations, Startup and Shutdown Procedures

Attachment 4: Emergency Shutdown Procedure and medical emergency instructions.

Attachment 5: Waste Management Procedure

Attachment 6: Hazard Identification and Mitigation

Attachment 7: Material Safety Data Sheets

Attachment 1 – Experiment Scope

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

1. *Explain why the work is being performed, the goal(s) of the experimental program*
    a. *If this is an update/revision of previous ESP describe all changes*
2. *Provide the stoichiometry of any chemical reactions and their heats of reaction (if applicable). Demonstrate the inherent thermal safety of your experiment through calculation.*
3. *Include a complete list of all chemicals, including household and common materials involved in the work.*
4. *Include a complete list of all equipment including their power requirements (e.g. autoclave, centrifuge, pump, heat bath etc.) involved in this work. Please note that 220V available is not available at the event.*
5. *Include a timeline for this experiment including setup, sample runtime(s)and teardown and whether any part of your experiment needs to operate overnight.*

Attachment 2 - Drawing of the Experimental Layout including P&ID

Provide a detailed drawing of the experiment including PFD(s) showing all inputs and outputs for equipment along with process information such as material and energy balances.

Attachment 3 – Normal Operations, Startup and Shutdown 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 **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 chemicals will be stored, how they will be transported to the location of the experimental work, how they will be transferred from storage into the experimental apparatus, and how they will be returned to storage.

Fill out the Take into account those items for which you indicate "yes" on the COE Lab Hazard Checklist, which is found at the end of this document.

Attachment 4 -. Emergency Shutdown Procedure

*Provide a **step-wise** procedure that describes how the equipment will be brought to a safe state in the event of an emergency. The description should include a detailed explanation of how to attend to potential medical emergencies that may result.*

Attachment 5 - 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. For your reference, an example of the NMSU Waste Tracking Form is included in the Developing an Experimental Safety Plan training course.

Attachment 6 – Hazard Identification and Mitigation

Fill out the attached Lab Hazard Assessment Form and describe here in detail all of the High Hazards associated with your experiment. 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 storage,*
- *housekeeping,*
- *fire*
- *biological hazards.*
- *substances that are highly reactive, radioactive, highly flammable, pyrophoric, highly toxic, mutagenic, teratogenic, carcinogenic, or have very low exposure limits,*
- *high voltage, high RF, x-ray, laser (class 3b or 4),*
- *high temperatures*
- *high pressure or pressurizing vessels.*

When in doubt about whether a substance represents a HIGH HAZARD, ask for assistance.

Attachment 7 – Safety Data Sheets (SDS) for All Chemicals Used/Generated in Experiment

Provide a complete list all of your chemicals and materials. Send an SDS document for each item, in PDF format, along with the ESP document.

College of Engineering Lab Hazard Assessment			
Activity	Yes	No	Comments
Working with gas under pressure, in gas cylinders or as part of experimental conditions			
Working with water volume in excess of 1 gallon			
Working with corrosive Liquids			
Working with organic solvents or flammable chemicals			
Working with acutely toxic , carcinogenic or highly hazardous chemicals			
Working with air or water reactive chemicals			
Working with engineered nanomaterials such as carbon nanotubes, silver wire, carbon fiber etc. or other dusts with particle sizes <10 um			
Working with potentially explosive chemicals			
Working with temperaturs <0C or >100C			
Working with radioactive compounds			
Working with Class 3 or Class 4 Lasers			
Working with cryogenic materials including dry ice			
Working with liquids >100C including from sources such as oil bath, water bath, pressure vessel, autoclave etc.)			
Working with open flames			
Working with loud equipment (>85 db)			
Working with a centrifuge			
Working with a sonicator			
Working with sharp objects such as needles, knives, razor blades etc.			
Working with machine hazards such as pinch points, caught by or stuck by dangers etc.			
Working with electrical hazards such as un-insulated wiring, exposed control panels, wet conditions, etc.			
Working with electrical voltage in excess of 110V			
Working with batteries, all types such as lead-acid, nickel-cadmium, lithium etc.			
Working with high center of gravity hazards such as tall apparatus that requires extra support etc.			