WERC Design Contest **ESP# WERC- 2019**

Experiment Safety Plan

Rev _1__

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. Because the labs are open 24/7, there may be occasions (such as a late night or over weekends) when there are no other people working in the lab. 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, and a "dry run" of the 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 the CHO can approve/disapprove any part of the ESP. The CHO can further assemble a committee of individuals with appropriate technical or EH&S background to assist in reviewing the ESP. It is the goal of the CHO to help the researcher(s) find the safest method(s) of conducting an experiment. The CHO, or any faculty member, may stop lab activity of individuals not following good lab practices.

	Name	Signature	Date
School and Team	University of California, Riverside/ Solair	NA	NA
Faculty Advisor	Dr. Kawai Tam		
Researcher	Vanessa Coria		
Researcher	Rayed Ahmed		

Researcher	Soraya Johnson		
Researcher	Samantha Vu		
Researcher	Tony Johnston		
Researcher			
EH&S (at request of COE Safety)			

NMSU WERC Design Contest Experimental Safety Plan (ESP)

This document must be typed.

Task # (as given on WERC Website)	Task 6: Open Task	
Name/Title of Experiment:	Solair/ Solar Thermal Energy Closet	
Booth Number:	TBD	
Location Inside/Outside	Outside	
Emergency Contacts (Required):	EMERGENCY	911
Function	Name	Contact Phone (at Event)
Experiment Coordinator	Stefan Perez	915-731-5710
Safety Coordinator	Juanita Miller	575-415-7999
Compliance Officer/Samples	Jalal Rastegary	915-540-5391
Faculty Advisor	Dr. Kawai Tam	760-490-6348
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*
3. *Demonstrate the inherent thermal safety of your experiment through calculation or through the use of accelerating rate calorimetry data.* https://chme.nmsu.edu/research/ehs/experimental-safety-plan-esp/esp-energetics-calculation/ *)*
4. *Include a complete list of all chemicals (reactants and products) involved in the work.*
5. *Include a complete list of all equipment (e.g. autoclave, centrifuge, pump, heat bath etc.) involved in this work*
6. *Include a timeline for this experiment including setup, sample runtime(s)and teardown*

In order to demonstrate the capabilities of our project, we plan to use a scaled down model of the system. The system consists of a solar collector, shelving, an inlet fan, a microcontroller, insulated vent tubing, temperature sensors, a container lined with fiberglass reinforced plastic, and heat lamps in the event that the system needs to be moved indoors if it is too windy outside.

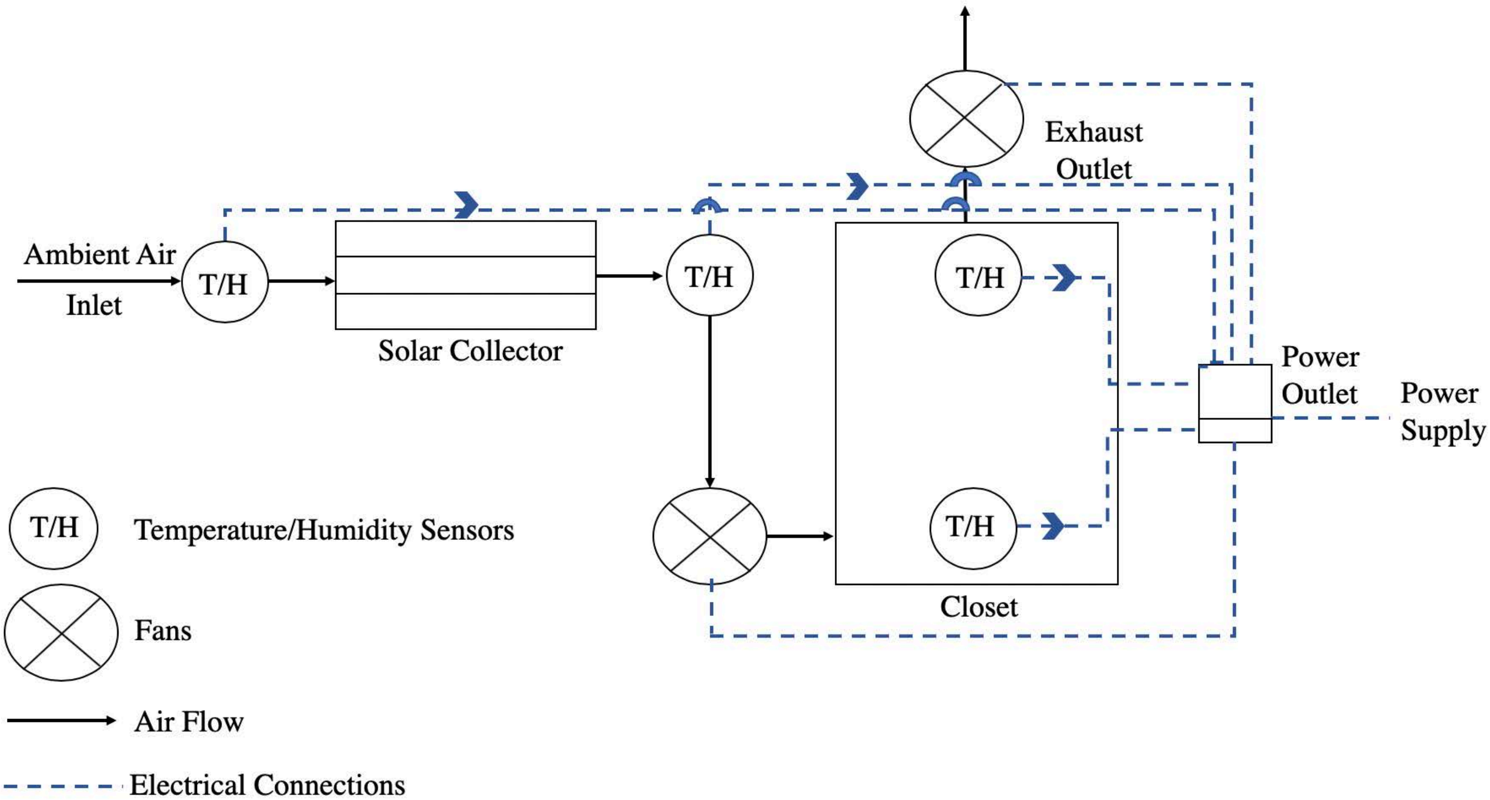
To demonstrate the solar collector's potential we have created a system that will use solar energy to display the effectiveness of the solar collector. The goal is to show how the collector is designed to provide sufficient residence time to allow the air to heat up while an integrated microcontroller modulates the fan speed to provide adequate convection into the system. The system is designed to reach an air temperature of 170 degrees Fahrenheit and as the microcontroller reads the temperature it then increases or decreases the fan speed in order to increase or reduce residence time to modulate the temperatures inside the unit. The process only uses thermal radiation from the sun so there is a maximum amount of heat flux exposure to mitigate the chance of overheating. The container where the clothes will be kept is insulated to reduce any heat loss so that the user will not experience any burn risks when interacting with the system. The fan is ensured to face conditions lower than the maximum conditions that it can withstand to prevent any damage. The duct lining is thermally insulated to again prevent injury with interaction.

Setup for this model will be simple as it will involve assembling the shelving unit, and placing the solar collector with the pre-attached ducting, fan, and integrated microcontroller. To conduct trials we will first turn on the microcontroller and place our desired piece of wet clothing in the thermally insulated container. The controller will then read the temperature in the solar collector and adjust the fan speed accordingly. After sufficient time has passed we will turn off the system and open the closet. There will be a run time of 45 minutes since the system is small. When it comes to tearing the unit down, we will need to disconnect it from power, disassemble the shelving, and pack up the rest of the equipment, the total weight of all the materials is roughly 100 pounds so the team will work together taking it apart and packing it. The overall goal of the experiment is to show how the running time of the clothes in the dryer will be just the same as if it were dried in a conventional dryer; only that the solar thermal closet will be more energy efficient.

In the event that the weather is poor and it is too windy for our system to be displayed outside we will use the heat lamps to mimic the heat of the sun. We will then need to connect our heat lamps to the power outlets and turn them on when the microcontroller is also turned on.

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

Provide a detailed drawing of the experiment including P&ID's showing all inputs and outputs for equipment..



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 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.

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

-The equipment will be able to function only once the system consisting of 2 fans and 4 sensors are powered with the power supply. The heating lamps will also be powered from the power supply, in the event the display is moved indoors.

-These sensors will be placed throughout the system and can be seen in attachment 2. When the system is in an inoperative state the team will load the closet with the damp clothes.

-Once the clothes are placed into the closet the team will start the microcontroller to start the first run.

-No PPE will be required during the operative state since this is a consumer experiment. The only PPE required will be during the setting up and dismantling of the system, gloves will be used for this part.

-In order to meet the required element of drying clothes the system will run for the duration of 45 minutes.

-The fans will be operating at an optimal speed to get the adequate temperature within the closet to dry the clothing.

-Once the unit has completed the 45 minutes the system will be stopped and the clothes will be taken out of the closet.

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.*

There are multiple systems in place to bring the system to a safe shutoff. The first is that the temperature of the system is constantly monitored and the fan speed is regulated. The last line of defense if none of the electronics function is to disconnect the system from any power sources manually. The potential risk of this project is entirely heat-based and the system should never reach more than 170 degrees Fahrenheit or about 76 Celsius. There could be a risk of burns in the event there is too much heat flux going into the system. The best way to attend to the burns is by applying cold water to the affected area, thus it will be necessary to be in the vicinity of a faucet with a cold water supply.

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. An example Waste tracking form is attached for reference.

The benefit of our system is that it uses solar radiation to heat air, which is then blown through the system to dry damp clothes. All of our equipment in the system is designed to be reusable, long-standing, and produce no waste. The byproducts from our system are humid air which is exhausted back into ambient conditions and the water from the clothes that will be collected in a tray at the bottom of the closet.

Attachment 6 – Hazard Identification and Mitigation

Identify ALL HIGH hazards associated with the 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, and/or*
- *biological hazards.*

Examples of HIGH hazards to include (list not exhaustive):

- *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, and*
- *high pressure or pressurizing vessels.*

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

For each HIGH hazard (use the checklist as a guide to identifying these hazards, chme.nmsu.edu/files/2013/11/Lab-PPE-selection1.pdf), provide the following information:

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.*

The biggest hazard with our system is that it uses solar energy to increase the temperature of air to dry clothing. The temperatures in the system are not designed to reach more than 170 degrees Fahrenheit which is less than the boiling point of water. However, if there was a high heat flux coming from our energy sources there could be a fire risk. We have engineering controls in place such as temperature sensors and the microcontroller regulation of the system, as well as operational controls in place to prevent the operation at a temperature above 170 degrees Fahrenheit. The exhaust from the system is warm humid air so there is a possible chance of discomfort if standing there. There is no PPE required to use our system since the microcontroller does all the work for the settings so there is no special training associated with our system as well. The only PPE required would be to move the solar collector and take down the equipment. Since the equipment will be outside the team will use gloves and sunglasses to ensure protection from getting any type of burn from the solar collector.

In the event that some of the wiring does not function properly the team plans to have a fire extinguisher to extinguish any of the malfunctions.

If weather conditions are poor and it is too windy outside there will be an array of heating lamps gaining energy from the electrical sources. It will be necessary to use precautions as the apparatus for the heating lamps could cause an electrical fire if not minded carefully.

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

There will not be use of chemicals or chemicals generated for this experiment.

Attachment 8 – NMSU Job Hazard Assessment Checklist

NMSU Lab (JHA) Hazard Assessment (Questions EH&S -http://safety.nmsu.edu or 575-646-3327) Sept.2012

Are the following activities performed in the lab?		**Chemical Hazards**	
Activity	Y/N	Potential Hazard	Applicable PPE
Working with small volumes (<4 liters) of corrosive liquids.	If yes	Eye or skin damage.	Safety glasses or goggles. Light chemical-resistant gloves. Lab coat.
Working with large volumes (>4 liters) of corrosive liquids, small to large volumes of acutely toxic corrosives, or work which creates a splash hazard.[1]	If yes	Poisoning, increased potential for eye and skin damage.	Safety goggles. Heavy chemical-resistant gloves. Lab coat and chemical-resistant apron.
Working with small volumes (<4 liters) of organic solvents or flammable organic compounds.	If yes	Skin or eye damage, potential poisoning through skin contact.	Safety glasses or goggles. Light chemical-resistant gloves. Lab coat.
Working with large volumes (>4 liters) of organic solvents, small to large volumes of very dangerous solvents, or work which creates a splash hazard.[1]	If yes	Major skin or eye damage, potential poisoning through skin contact. Fire.	Safety goggles. Heavy chemical-resistant gloves. Flame-resistant lab coat (e.g. Nomex).
Working with toxic or hazardous chemicals (solid, liquid, or gas)[1, 2]	If yes	Skin or eye damage, potential poisoning through skin contact.	Safety glasses (goggles for large quantities). Light chemical-resistant gloves. Lab coat.
Working with acutely toxic or hazardous chemicals (solid, liquid, or gas)[1, 2, 3]	If yes	Increased potential for eye or skin damage, increased potential poisoning through skin contact.	Safety goggles. Heavy chemical-resistant gloves. Lab coat.
Working with an apparatus with contents under pressure or vacuum.	If yes	Eye or skin damage.	Safety glasses or goggles, face shield for high risk activities. Chemical-resistant gloves. Lab coat, chemical-resistant apron for high risk activities.
Working with air or water reactive chemicals.	If yes	Severe skin and eye damage. Fire.	Work in inert atmosphere, when possible. Safety glasses or goggles. Chemical-resistant gloves. Lab coat, flame resistant lab coat for high risk activities (e.g. Nomex). Chemical-resistant apron for high risk activities.
Working with potentially explosive chemicals.	If yes	Splash, detonation, flying debris, skin and eye damage. Fire.	Safety glasses, face shield, and blast shield. Heavy gloves. Flame-resistant lab coat (e.g. Nomex).
Working with low and high temperatures.	If yes	Burns, splashes. Fire.	Safety glasses. Lab coat. Thermal insulated gloves, when needed.
Minor chemical spill cleanup.	If yes	Skin or eye damage, respiratory damage.	Safety glasses or goggles. Chemical- resistant gloves. Lab coat. Chemical-resistant apron and boot/shoe covers for high risk activities. Respirator as needed. Consider keeping Silver Shield gloves in the lab spill kit.

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NMSU Lab (JHA) Hazard Assessment (Questions EH&S-http://safety.nmsu.edu or 575-646-3327) Sept.2012

Are the following activities performed in the lab?		**Biological Hazards**	
Activity	Y/N	Potential Hazard	Applicable PPE
Working with human blood, body fluids, tissues, or blood borne pathogens (BBP). [5]	If yes	Exposure to infectious material.	Safety goggles with face shield or facemask plus goggles, latex or nitrile gloves, lab coat or gown.
Working with preserved animal and/or human specimens.	If yes	Exposure to infectious material or preservatives.	Safety glasses or goggles, protective gloves such as light latex or nitrile for unpreserved specimens (select protective glove for preserved specimens according to preservative used), lab coat or gown.
Working with radioactive human blood, body fluids, or blood borne pathogens (BBP).	If yes	Cell damage, potential spread of radioactive contaminants, or potential BBP exposure.	Safety glasses (goggles for splash hazard), light latex or nitrile gloves, lab coat or gown.
Working with agents or recombinant DNA classified as Biosafety Level 1 (BSL-1).	If yes	Eye or skin irritation.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves for broken skin or skin rash, lab coat or gown.
Manipulation of cell lines, viruses, bacteria, or other organisms classified as Biosafety Level 2 (BSL-2). 5	If yes	Exposure to infectious material, particularly through broken skin or mucous membranes.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves, lab coat or gown.
Manipulation of infectious materials classified as Biosafety Level 2 facility with BSL-3 practices (BSL-2+).	If yes	Exposure to infectious materials with high risk of exposure by contact or mucous membranes.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves (double), lab coat or disposable gown (preferred), surgical mask.
Manipulation of infectious materials classified as Biosafety Level 3 (BLS-3).	If yes	Exposure to infectious materials with high risk of exposure, particularly through the inhalation route.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves (double), full disposable gown or Tyvek suite (preferred), respirator, shoe cover or dedicated shoe.
Working with live animals (Animal Biosafety Level 1, ABL-1).	If yes	Animal bites, allergies.	Safety glasses or goggles for protection from splash or other eye hazard, light latex, nitrile or vinyl gloves for broken skin or skin rash, lab coat or gown. Consider need for wire mesh glove.
Working with live animals (Animal Biosafety Level 2).[5]	If yes	Animal bites, exposure to infectious material, allergies.	Safety glasses or goggles for protection from splash or other eye hazard, light latex, nitrile or vinyl gloves, lab gown, hair cover, shoe covers, surgical mask. Consider need for wire mesh glove.

Attachment 8 –NMSU Job Hazard Assessment Checklist

NMSU Lab (JHA) Hazard Assessment (Questions EH&S -http://safety.nmsu.edu or 575-646-3327) Sept.2012

Are the following activities performed in the lab?		**Radiological Hazards**	
Activity	Y/N	Potential Hazard	Applicable PPE
Working with solid radioactive materials or waste.	If yes	Cell damage, potential spread of radioactive materials.	Safety glasses, impermeable gloves, lab coat.
Working with radioactive materials in hazardous chemicals (corrosives, flammables, liquids, powders, etc.).	If yes	Cell damage or spread of contamination plus hazards for the specific chemical.	Safety glasses (or goggles for splash hazard), light chemical-resistant gloves, lab coat. Note: Select glove for the applicable chemical hazards above.
Working with ultraviolet radiation.	If yes	Conjunctivitis, corneal damage, skin redness.	UV face shield and goggles, lab coat.
Working with infrared emitting equipment (e.g. glass blowing).	If yes	Cataracts, burns to cornea.	Appropriate shaded goggles, lab coat.

NMSU Lab (JHA) Hazard Assessment (Questions EH&S -http://safety.nmsu.edu or 575-646-3327) Sept.2012

Are the following activities performed in the lab?		**Laser Hazards**	
Activity	Y/N	Potential Hazard	Applicable PPE
Open Beam			
Performing alignment, trouble-shooting or maintenance that requiresWorking with an open beam and/or defeating the interlock(s) on any Class 3 or Class 4	If yes	Eye damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters.
Viewing a Class 3R laser beam with magnifying optics (including eyeglasses).	If yes	Eye damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters.
Working with a Class 3B laser open beam system with the potential for producing direct or specular reflections.	If yes	Eye damage, skin damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters, appropriate skin protection. [7]
Working with a Class 4 laser open beam system with the potential for producing direct, specular, or diffuse reflections.	If yes	Eye damage, skin damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters, appropriate skin protection [7].
Non-Beam			
Handling dye laser materials, such as powdered dyes, chemicals, and solvents.	If yes	Cancer, explosion, fire.	Gloves, safety glasses, flame-resistant lab coat or coveralls.
Maintaining and repairing power sources for large Class 3B and Class 4 laser systems.	If yes	Electrocution, explosion, fire.	Electrical isolation mat, flame-resistant lab coat or coveralls.

Attachment 8 –NMSU Job Hazard Assessment Checklist

NMSU Lab (JHA) Hazard Assessment (Questions EH&S -http://safety.nmsu.edu or 575-646-3327)Sept.2012

Are the following activities performed in the lab?		**Physical Hazards**	
Activity	Y/N	Potential Hazard	Applicable PPE
Working with cryogenic liquids.	If yes	Major skin, tissue, or eye damage.	Safety glasses or goggles for large volumes, impermeable insulated gloves, lab coat.
Removing freezer vials from liquid nitrogen	If yes	Vials may explode upon rapid warming. Cuts to face/neck and frostbite to hands	Face shield, impermeable insulated gloves, lab coat.
Working with very cold equipment or dry ice.	If yes	Frostbite, hypothermia.	Safety glasses, insulated gloves (possibly warm clothing), lab coat.
Working with hot liquids, equipment, open flames (autoclave, Bunsen burner, water bath, oil bath).	If yes	Burns resulting in skin or eye damage.	Safety glasses or goggles for large volumes, insulated gloves (impermeable insulated gloves for liquids, steam), lab coat.
Glassware washing.	If yes	Lacerations.	Heavy rubber gloves, lab coat.
Working with loud equipment, noises, sounds, alarms, etc.	If yes	Potential ear damage and hearing loss.	Earplugs or ear muffs as necessary.
Working with a centrifuge.	If yes	Imbalanced rotor can lead to broken vials, cuts, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile gloves.
Working with a sonicator.	If yes	Ear damage, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile gloves, ear plugs.
Working with sharps.	If yes	Cuts, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile

Are the following activities performed in the lab?		**Nanomaterial Hazard**	
Activity	Y/N	Potential Hazard	Applicable PPE
Working with engineered nanomaterials[8].	If yes	Inhalation, exposure, dermal exposure.	Goggles, gloves, lab coat.

1 Use a chemical exhaust hood or other engineering control whenever possible. Activities conducted outside a hood or other engineering control (local bench exhaust) may need to be evaluated for a respiratory hazards. A respirator may be required & a respiratory protection program must be in place per EH&S Respiratory Protection Program. In addition to engineering controls and PPE, consider personal clothing that provides adequate skin coverage.

2 Dusty solids should be separately evaluated for the need to use respiratory protection.

3 For a list of acutely toxic chemicals, visit safety.nmsu.edu and navigate to Chemical Safety.

4 Chemical-resistant gloves are to be selected based on chemical(s) in use (see glove quide).

5 Use a Biosafety cabinet to minimize exposure or evaluatd by Biosafety Officer.

6 Laser pointers, copiers, and readers are not currently subject to general or specific PPE requirements.

7 Appropriate skin protection can include lab coat, gloves, sun block, barrier cream.

8 Nanomaterial work is to be evaluated for respiratory protection.

September 6, 2012 (after UCLA LHATS developed by http://www.ehs.ucla.edu/)

Attachment 9 – NMSU Waste Tracking Form (to be filled out at event)

Write Firmly- 2 Copy Form

NMSU Hazardous Waste/Material Tracking Form

Contents Hazards(Circle) Flammable Reactive Oxidizer Toxic Acid Base

Container Size in (ml or L) (Print) →

Container Type (Circle) → Glass Plastic Metal Fiber

Contents State (Circle) → Solid Liquid Sludge Gas

Chemical Contents (and diluent,including water,if applicable)	Concentration(%,M,PPM)	vol.(mL or L)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Total Volume of Contents (mL or L) →		

Generator's Name and Title		Phone #
Dept	Building	Room

EH&S Staff Use Only

Bay (circle) → Flam Poison Acid Base Bio UW

Initials	Sub Category	Process Drum	No 022757
Date received	Waste Codes:		

Attachment 9 – NMSU Waste Tracking Form (to be filled out at event)

NMSU CHEMICAL DISPOSAL PROCEDURES

1. Label each container to identify the contents **(Use NMSU Hazardous Waste/Material Tracking Form).**
   1.1 Circle Contents Hazards: Flammable, Reactive, Oxidizer, Toxic, Acid, Base.
   1.2 Write in Container Size: (250 mL, 4L, etc.).
   1.3 Circle Container Type: Glass, Plastic, Metal, or Fiber.
   1.4 Circle Chemical State: Liquid, Solid, Sludge, or Gas.
   1.5 Write in added chemical names (and their diluent, including water, if applicable), concentration (%, molarity, or ppm), and their volume in milliliters or liters. If necessary, make an estimate based on your "knowledge of process". **Do not abbreviate. Do not use chemical notations or structures.**
   1.6 When no more waste is to be added to container, write in total volume of contents in milliliters or liters.
   1.7 Write in the Generator (name of person completing the form or lab supervisor), Phone #, Department, Building, and Room #.
   1.8 Lower portion is for Environmental Health and Safety (EH&S) use only- **Leave Blank.**
   1.9 If more chemicals need to be listed, use as many extra, separate tracking forms as needed.
   1.10 Containers not labeled appropriately will be returned to the generator.
   1.11 Secure forms to container with plastic ties or adhesive tape.

2. Compatible chemicals may be collected in a single waste container and individual containers may be packaged in secondary containers according to the subclasses listed below **(not all inclusive)**. Call EH&S for assistance with highly hazardous materials or **unknown compatibility.**
   A. Flammables (Non-Halogenated Organic Solvents: Methanol, Acetone).
   B. Halogenated Organics (Chlorinated Solvents: Methylene Chloride, Chloroform)
   C. Combustibles (Oils, Coolant, Latex Paint).
   D. Poisons (Pesticides, Weak Organic Acids).
   E. Inorganic Acids (Hydrochloric, Sulfuric).
   F. Inorganic Bases (Sodium Hydroxide, Potassium Hydroxide).
   Always package separately the following high hazard compounds: Cyanide, Sulfide, Water/Air Reactive, Mercury, Organometallic, Undiluted Organic Peroxides, Strong Oxidizers, Strong Reducing Agents, Flammable Solids, Strong/Undiluted Amines, Polymerizables (Monomers), Radioactive, Biohazardous, Gas Cylinders, and Explosives.

3. **Empty containers must be rinsed (a minimum of three times)** with water or an appropriate solvent until less than 3% of the compound is present. Collect rinsate in the appropriate waste container. After rinsing, glass containers should be placed in a glass collection box for regular disposal. If the container is metal, plastic, or fiber, first **puncture** the container prior to disposal in the regular trash. If containers cannot be effectively rinsed, complete a tracking form and turn in as hazardous waste.

4. **Unknowns are not acceptable.** Waste components must be determined by knowledge of process or analytical method.

5. Package glass chemical containers for turn-in in a sturdy transport box with cardboard separators or packing material to prevent breakage. If you need additional boxes, notify EH&S when calling in a pick up request. Only combine compatible waste containers in a single transport box. Do not seal boxes, EH&S Personnel will inspect paper work and hazardous waste containers before transport.

6. At any one time, a research group may accumulate up to a **maximum of 55 gallons** of waste or one quart of Acutely Hazardous Waste in a designated **Waste Accumulation Point.** The storage containers must be **closed (finger tight)** and under the generator's control, i.e. in the same room **(See NMSU Waste Accumulation Point Inspection Checklist at www.nmsu.edu/safety).**

7. After tracking forms are completed, call EH&S **(646-3327)** to schedule removal of chemicals. Containers should be called in for pick up when **75% full** to comply with EPA regulations. Please do not overfill containers, always leave 10% headspace. Detailed **hazardous waste training** is provided by EH&S Staff. Please call for dates and times or visit our web site at **www.nmsu.edu/safety.**