Job Safety Assessment Form
Chem-E-Car
2016 Annual Student Conference Competition

University:	**Vehicle Name:**
JSA Author Contact Name:	**Author Email:**
Faculty Supervisor:	**Supervisor Email:**
Revision #:	**Revision Date**:

Purpose of Experiment / Equipment: Briefly describe your Chem-E-Car's design, intended mode for operation (source of power), intended mode for control (stopping), and major hazards and their control.

Describe your car's design:
Power source:
Stopping mechanism: `
Hazards inherent in design:
Safety measures:

Expected Operating Conditions:

Temperature	Pressure
Normal:	Normal:
Minimum:	Minimum:
Maximum:	Maximum:

This page applies to your home institution – not the competition site. Please attach a floor diagram of the laboratory where you will be building and testing your vehicle. List the location of available safety equipment and spill response supplies on this diagram.

Personal Protective Equipment (PPE) : Check all PPE worn during operation of this Chem-E-Car. Do not list these in the procedure section.

☐ Long Pants	☐ Safety Glasses	☐ Hard Hat	☐ Apron
☐ Long Sleeves	☐ Splash Goggles	☐ Insulated Gloves	☐ Ear Protection
☐ Non-porous Shoes	☐ Face Shield	☐ Chemical Gloves	☐ Other:

Available Safety Equipment – Provide the location of each item shown below at your home institution where your vehicle will be operated and tested. Show the location of this equipment on your provided floor plan. If not available, type "NA" in the field.

Item	Location
Fire Extinguisher:	
Eyewash:	
Safety Shower:	
Telephone:	
First Aid Kit:	
Spill Containment	
Other:	

Spill Response Supplies - Provide the location of each item shown below at your home institution where your vehicle will be operated and tested. Show the location of this equipment on the attached floor plan. If not available, type "NA" in the field.

Item	Location
Spill Kit:	
Floor-Dri:	
Spill Dikes:	
Sodium Bicarbonate:	
Drain Plugs:	
Spill Pillows:	
Mercury Spill Kit:	
Other:	
Other:	

Disallowed Activities: All activities listed below are not allowed and will result in a multi-year disqualification of your university from ChemE car competition and possible fines.

Item
(a) No transport of chemicals in private, university or rental vehicles either to or from the competition.
(b) Chemicals must not be stored in hotel rooms or other facilities not rated for chemical storage. Approved chemical storage will be provided at the host site.
(c) No vehicle testing in hotel or dorm hallways, warehouses, or other facilities that are not designed for chemical handling. This includes your university and the competition site.
(d) No improper disposal of chemicals at the conclusion of the competition. All chemicals shipped to the competition site must be disposed of in a safe and environmental fashion following all local, state and national regulatory measures. Chemical disposal will normally be provided by the host site.

Disallowed Vehicles: All of the items listed below are not allowed.

Item	Explanation
(a) Flames and/or smoke	Both inside and outside the vehicle, except for commercial internal combustion engines. See ChemE car rules for using commercial internal combustion engines. **Note that NO SMOKE is allowed from any vehicle, including those using internal combustion engines.**
(b) Liquid Discharge	Liquid may not be discharged under normal operating conditions.
(c) Open and/or improperly secured containers	Containing chemicals having an NFPA rating of 2 or greater. No open containers allowed at the starting line or during the operation of your vehicle. All containers with these chemicals must have secure lids and must be secured to the vehicle. All containers brought to the starting line must have lids, be properly labeled, and proper personal protective equipment must be used.
(d) Chemical pouring at starting line	Any chemicals with an NFPA rating of 2 or greater. Use a holding vessel on vehicle, with valve, to load starting chemicals.
(e) Regulated Chemicals	A number of chemicals are listed by OSHA as a special hazard. See list below. OSHA has a special regulation for each chemical. See www.osha.gov for details.
(f) Highly Reactive / Unstable Chemicals	Any chemical, raw material, intermediate or product with an NFPA reactivity / instability rating of 4.
(g) Hydrogen peroxide	Hydrogen peroxide at concentrations of greater than 30% are not allowed.

Regulated chemicals: asbestos, coal tar pitch volatiles, 4-nitrobiphenyl, alpha-napthylamine, methyl chloromethyl ether, 3,3'-dichlorobenzidine, bis-chloromethyl ether, beta-naphthylamine, benzidine, 4-aminodiphenyl, ethyleneimine, beta-propiolactone, 2-acetylaminofluorene, 4-dimethylaminoazo-benezene, n-nitrosodimethylamine, vinyl chloride, inorganic arsenic, benzene, 1,2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, formaldehyde, 4,4'-Methylenedianiline, 1,3-butadiene, methylene chloride.

Vehicle Primary Hazards Checklist: Check the left hand column box if the hazards listed below exist on the vehicle. Then check the applicable means of control for each hazard.

Hazard (check if present)	**Control**
☐ (a) Pressure	Anything greater than 1 psig? **Must meet all requirements below:** ☐ Pressure gauge (must read to 2x max. operating pressure) ☐ Emergency relief device set to no more than 1.1 times max. operating pressure. Relief sizing calculations must be provided. ☐ Emergency relief device in proper location. ☐ Pressure certification – see Pressure Vessel Testing Protocol ☐ Proper management system to prevent over or mis-charging. ☐ All car components exposed to pressure must be certified to operate at that pressure. Provide manufacturer's pressure specifications. ☐ No PVC, cPVC or polyethylene terephthalate (PETE or PET) plastics in pressure service **Must have measurements or calculations to prove maximum operating pressure. Max allowable pressure this year is 500 psig.** **See ChemE car rules for more details on these requirements.**
☐ (b) Toxic	Any chemicals with an NFPA toxicity of 2 or greater? ☐ Doubly contained and handled properly.
☐ (c) Flammable	Any chemicals with an NFPA flammability rating of 2 or higher? ☐ Doubly contained and handled properly
☐ (d) Reactive	Any chemicals with an NFPA instability / reactivity rating of 2 or 3? **Chemicals with a 4 rating are not allowed.** ☐ Doubly contained and handled properly.
☐ (e) Temperature	Any exposed surface greater than 150 deg. F or under 32 deg F? ☐ Insulation or barrier to prevent contact.
☐ (f) Electrical	Exposed wiring and electrically energized components are ignition, electrocution, and a shorting / fire hazard. Alligator clips and twisted wire connections are not allowed – use binding posts or banana plugs for a more secure connection. ☐ Proper electrical insulation and connections provided.
☐ (g) Mechanical	Any fast moving parts (meshing gears, belts or chains) that are pinch hazards? ☐ Guards present and adequate.
☐ (h) Oxygen	All components exposed to oxygen must be ☐ certified for oxygen service. ☐ thoroughly cleaned of contaminants as per instructions in rules. ☐ not used previously for other types of service.
☐ (i) Biohazards	☐ No biohazards greater than biohazard level 1 either during the design, development, preparation or competition phases of your car.

Fabrication & Operation Additional Hazard Detail Check List: Check all hazards that are likely to be encountered during your Chem.-Car construction and operation. List the major source(s) of the hazard and describe how the hazard(s) will be controlled. If both construction and hazard columns are checked in an individual row, then the hazards should be identified separately for both the construction and operation.

Hazard	Present During		Control Method(s)[1]	PPE Required[1]
	Construction?	Operation?		
Pressure	☐	☐		
Toxicity	☐	☐		
Flammability	☐	☐		
Reactivity / Instability	☐	☐		
Hot Surfaces/ High Temp > 150 F	☐	☐		
Cold Surfaces/ Low Temp < 0 C	☐	☐		
Electrical	☐	☐		
Arc welding	☐	☐		
Gas welding	☐	☐		
Lathe	☐	☐		
Milling machine	☐	☐		
Handheld power tools	☐	☐		
Drill press	☐	☐		
Other mechanical hazards	☐	☐		
Paint spraying	☐	☐		
Ionizing radiation	☐	☐		
Laser radiation	☐	☐		
Asphyxiates	☐	☐		
Open flames	☐	☐		
Potential Spills	☐	☐		
Biohazards:	☐	☐		
Other:	☐	☐		
Other:	☐	☐		

Chemical Information Page

Fill in as much data below as available. If data are not available, leave the field blank.

Chemical Quantities: List below the chemical names, concentrations, and total quantity of chemical required for the competition.

Chemical Name	Chemical State Solid, Liquid, Gas	Concentration Required Be sure to list units!	Total Quantity Required for Competition Be sure to list the units!

Chemical Properties and Hazards for ALL CHEMICALS, including reactants, intermediates and products.

Chemical Name	Physical State S, L, G	NFPA Ratings*				Incompatible Chemicals List chemicals present within the laboratory, and any others that may come in contact.	Flash Point Temp.	Flammability Limits	
		H	F	S	Sp.			LFL	UFL

*NFPA Ratings: **H** – Health, **F** – Flammability, **S** – Stability, **Sp.** – Special

Chemical Toxicology, Regulation and Disposal: List the same chemicals that appear above, in the same order.

Chemical Name	Toxicology			Hazardous Waste Number	OSHA Regulated?	Personal Protective Equipment Specific to this Chemical
	TWA	PEL	Other			
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	

Chemical Reactions: Provide details below on any chemical reaction(s) that occur in your process. Please show the species involved, the stoichiometry and the heat of reaction, if available. Also list side reactions and any other reactions that may impact safety.

Biohazards: Provide details below on any biological hazards that may occur during the design, development, preparation or competition phases of your car. Please list the biological hazards, the biohazard level, and a description of how these agents will be safety handled.

Job Safety Assessment Form
Safe Operating Procedures Page

Provide step-by-step details for each of the sections shown below. Identify the hazards, the control methods and the personal protective equipment (PPE) required. Provide adequate detail so that the reviewers of this document will have adequate understanding of your procedure to pass judgment on the safety of your vehicle.

The **Emergency Shutdown** section should have only one or two steps required to stop your vehicle and bring it to a safe state.
The **Start-Up Procedure** section should list all the steps required to prepare your chemicals and vehicle.
The **Run Time Procedure** should describe all steps to operate your vehicle at the starting line of the competition.
The **Shutdown Procedure** should describe the steps normally taken to shutdown your vehicle at the end of your competitive run.
The **Cleanup / Waste Disposal** section should list all the steps required to clean your vehicle of all chemicals and proper chemical disposal.

Sequence of Steps	Potential Hazards	Procedure to Control Hazard	PPE or Equipment Required
Emergency Shutdown			
Start-up Procedure			
Run Time Procedure			
Shutdown Procedure			
Cleanup / Waste Disposal			