**Certifications Page**

**ChemCar 2021 – Rev. 1.0.2021**

**University**:       **Team Name:**

**Team leader name**:       **Team leader Email:**

**Team leader phone:**

**Faculty Supervisor:**       **Supervisor Email:**

1. **Required Safety instructions for laboratory work:**

List below each student team member and the date of safety instructions:

Advisor Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Member Name Date Signature

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Included Documents**

The following documents are included in the safety analysis package

Completed Safety analysis

A quantitative design basis for pressure relieving load

Sizing calculations for a pressure relief device

Test procedure and results for a pressure relief

Pressure Vessel Testing Protocol

A picture of the vehicle after construction has been completed.

Material Safety Data Sheets and operating instructions for all chemicals used

Free text risk assessment according to safety rules and safety guidelines

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **Faculty Certification:**

I certify that this student team has followed all of the safety rules and has completed a safety analysis under my supervision or with an outside expert

Faculty Advisor Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Faculty Advisor Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_

Outside Expert Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Outside Expert Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_

1. **Student Certification:**

We certify that we have followed all of the safety rules, have completed a safety review with our faculty supervisor or with an outside expert.

Team Member Signature Date

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

**Safety Analysis**

**ChemCar 2021– Rev. 1.0.2021**

**University**:       **Team Name:**

**Team leader name**:       **Team leader Email:**

**Team leader phone:**

**Faculty Supervisor:**       **Supervisor Email:**

**Revision #**:       **Revision Date**:

**Purpose of Experiment / Equipment:** Briefly describe your ChemCar’s design, intended mode for operation (source of power), intended mode for control (stopping), and major hazards and their control.

|  |
| --- |
| Draw the process flowsheet (P&ID) of your ChemCar: |
| 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: |

**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 barg?  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. Containment vessel for blow-off gas.  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.**  **See ChemCar rules for more details on these requirements.** |
| (b) Toxic | Any chemicals which has acute toxicity?  Not allowed |
| (c) Flammable | Any chemicals which is flammable?  Doubly contained and handled properly |
| (d) Reactive | Any chemicals which are self-reactive / thermally unstable?  Doubly contained and handled properly. |
| (e) Temperature | Any exposed surface greater than 60°C or under 0°C?  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. |
| (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 ChemCar 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)** | **PPE Required** |
| **Construction?** | **Operation?** |
| Pressure |  |  |  |  |
| Toxicity |  |  |  |  |
| Flammability |  |  |  |  |
| Reactivity / Instability |  |  |  |  |
| Hot Surfaces/ High Temp > 60 °C |  |  |  |  |
| 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. **Be sure to list the units!** If data are not available, leave the field blank.

Material safety Datasheet (MSDS/SDS) for each named [hazardous](http://dict.leo.org/ende?lp=ende&p=ziiQA&search=hazardous&trestr=0x801) [material](http://dict.leo.org/ende?lp=ende&p=ziiQA&search=material&trestr=0x801) is mandatory.

**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** | **Total Quantity Required for Competition** | **Specific Personal Protective Equipment / Remarks** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemical Name** | **Physical State**  **S, L, G** | **GHS**  **Symbol(s)** | **H&P- Statements (No. only)** | | **Incompatible Chemicals**  List chemicals present within the laboratory, and any others that may come in contact. | **Flash Point**  **Temp.** |
| *Hazard Statements* | *Precautionary Statements* |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**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.

|  |
| --- |
|  |

**Safety Analysis 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 shut down 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** |  |  |  |
|  |  |  |  |

**Appendix**

Attach all MSDS for all used Chemicals here:

Attach all calculations (including explanations) here: