I. Summary of CDR report

Team Summary
- University of Hawai‘i – Windward Campus
- Hale ‘Imiloa
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  Kane‘ohe Hawai‘i 96744
- Dr. Joseph Ciotti (Principle Investigator)
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  Jasmine Maru

Launch Vehicle Summary
- Rocket Name: Leo Hano
- The team rocket is to be 84 inches in length, with a 4” diameter
- The rocket is designed to accept an Aerotech K560W 75-mm motor
- The rocket is designed to have a dual deployment recovery system incorporating a 36” drogue deployed at apogee, and a 96” main to be deployed at 500’ altitude.
- 10/10 rail with a length of 10’

Payload Summary

In order to continue its efforts at promulgating interests in science, technology, engineering, and mathematics, Windward Community College’s (WCC) Center for Aerospace Education (CAE) wanted to acquire a re-usable rocket to perform diagnostic testing for several of our education outreach projects: A Rocket Launch for International Student Satellites (ARLISS), testing for the National CanSat competition, various High School Science Fair experiments, and as the hands-on component for a course on Rocketry that is to be integrated into the University of Hawai‘i curriculum. The rocket would be designed to carry a non-specific payload, of limited weight and size, to an altitude of 1 mile (5280’), and then return safely to its launchers. The targeted altitude can change with the incorporation of our aero-brake system and different engine selection. It will also have the ability to maintain the payload through entire flight or to eject its payload at apogee. These options depend on the needs of the outreach program that it is being used for. The payload carrier would have an on-board data acquisition system capable of determining where the payload compartment is, how fast it is going, how high above ground level it is, and what angle the payload section is above the horizon.
In addition, the payload carrier electronics will also include the ability to perform a ‘voice–over’ to a ground PA system to inform all observers of the information being collected and the status of the rocket.

II) Changes made since PDR (w/ reason for change)

- Changes made to Vehicle Criteria

We have since added detailed plans of the rocket. These diagrams cover the entire rocket, but focus on specific sections of the rocket. Greater detail of the particular area of the rocket can be reached, this will aid in the understanding of the physical components and layout of the rocket.

- Changes made to Payload Criteria

No changes to Windward Community College’s (WCC) payload have been made since the PDR. However, detailed information of the subcontracted payload that will be carried in the WCC payload has been added.

- Changes made to Activity Plan

There have been no changes in WCC’s team activity plan since the PDR.

III. Vehicle Criteria

With outreach being the main focus of WCC’s USLI rocket, our vehicle must be able to successfully carry different payloads for various outreach projects. These payloads must meet all of our dimensional and weight limitations, to guarantee the safety of the rocket, payload, and observers.

The WCC USLI rocket is designed with Education Outreach in mind. Several design constraints are considered with this thought paramount. Since projects are to be canvassed from interested high school students or participating colleges, the payloads are somewhat unspecific. It was thought that a payload weight limit of 1 kg would allow some latitude for the high school students, was twice the weight limit allowed by the National CanSat competition, and more than enough for the past electronic payload testing that has previously been performed for the ARLISS program. Along with this was the understanding that volume constraints must also be outlined; whereas we will be pushing the National CanSat competition, we did not want this to be the only option for interested students. A cylindrical volume, having a diameter of 3.75 inches, and length of 10 inches, was optimal for our purposes. If the payload weighs less than 1kg, to reach the desired altitude, extra mass can be added, a different motor can be selected, or the aero-brake system can be used. Any changes made will be thoroughly tested using our simulation software (RockSim) and our
to scale prototype to ensure that all safety requirements are still maintained throughout the rocket's flight.

Determination of the motor that is going to be used in USLI was more problematic. It was thought that we should initially over-power the rocket to carry a heavy payload to a height greater than 1 mile. By suitably deploying aero-brakes, open throughout the flight, and extra mass, it was thought that we could attain the right height. It was this in mind, as well as some simple kinematics, that led us to our initial choice of the L1400 motor. After further consideration, coupled with the arrival of our flight simulation (RockSim) routine, we concluded that this was inherently un-safe. The flight simulation showed that the amount of mass that would have to be added to the rocket using an L1400 motor was too much to guarantee a safe recovery. Further flight simulations showed that we would get a better flight profile using a K560 motor, which implied a 75-mm diameter motor mount. The 75/2560 casing, required for a K560 motor, determined that the motor mount length was to be at least 11 inches. A 20-inch length was chosen for convenience, and offers some latitude in future choice of motor, should the need arise.

The overall length of the rocket was determined not so much by the payload, as by the dual deployment recovery that is planned. Rocket design started with the nose cone, standard ogive 1:4.25, yields a nose cone length of 17 inches. The choice of this type of nose cone was dictated by the fact that this shape is commercially available. This is where the data acquisition electronics, monitoring the rocket flight profile and status of the payload, will be located. The payload section of the rocket is 19 inches in length; 4 inches as the nose cone shoulder, 10 inches as the payload section, and 5 inches is half the coupler length. Below the payload section of the rocket is the avionics section, chosen to be 18 inches in length; 7 inches to accommodate 5 inches of coupler and stowage of the drogue chute, 6 inches for the avionics electronics, and 5 inches to accommodate the coupler. The avionics electronics will consist of 2 G-Wiz HCX flight controllers, and an PerfectFlight MAWDs as a redundant back-up system. The Booster section is 30 inches in length, of which the motor mount will take up the lower 20 inches. The upper 10 inches will accommodate 5 inches of coupler, and act as the main chute stowage area. It goes without saying that this section will hold the three fins, and the aero-brake assembly. This yields an overall length of 84 inches (7 feet).

We plan to use G-10 fiberglass as the main tube material, with two 10-inch couplers, three ¼-inch thick plywood bulkheads, two ½-inch thick Birch wood centering rings, and three fiberglass trapezoidal fins. We estimate the un-loaded weight of our rocket to be 13.9 lbs, and a pad weight of just under 20 lbs.

The flight profile that our rocket will follow is the standard dual deployment routine, and has been simulated (under various launch conditions) on RockSim. The flight will begin with the boost phase. The K560 motor will produce an average thrust of 120 lbs (giving us a thrust to weight ratio of 6), with a burn time of 4.95 seconds. The maximum estimated acceleration is ~8 g’s (258 ft/s/s), with an estimated maximum speed of 500 mile/hr (735 ft/s). At motor burnout, the
rocket then enters its coast phase. We expect the rocket to reach apogee ~25 seconds after launch. At apogee, a 36-inch drogue chute will be deployed, yielding an initial descent speed of ~ 60 ft/s. At an altitude of 500 ft, a 96-inch main chute will be deployed, slowing the rocket descent rate to less than 20 ft/s, which we believe to be a safe descent rate.

**Design and Verification of Launch Vehicle**

- Mission Statement, Requirements, and Mission Success Criteria

**Mission Statement**

It is the mission of the WCC Leo Hano rocket to promote interest in science, technology, engineering, and mathematics, for high school and college students, by providing a safe, reusable lifting body with safety being the primary concern.

This means that the safety of our prelaunch, flight, and recovery are of the highest priority. To have a successful mission the team must ensure that all safety requirements are maintained throughout the mission. The team must also meet all the following criteria below. A perfect mission with absolute success will meet all of the following criteria.

**Mission Criteria:**

- Payload functions properly
- Successful recovery the rocket and all its components
- Both parachutes deployed
- The rocket is completely intact
- The data is downloadable via EEPROM
- The voice-over performs it programmed duties (public is addressed)
- The subcontracted payload performed as it was planned to
- The appropriate levels of safety are maintained throughout the entire process of preparation, launch, flight, and recovery of the rocket

To achieve any type of success in the mission, the rocket must have deployed a parachute and must be intact upon recovery, meaning it has the ability to be considered flight ready and meets all safety requirements without any repairs done it. If the team does not have a parachute deployment and the rocket is not intact upon recovery, the mission will be considered a failure. A partially successful mission will be defined as meeting 6 of the 8 criteria, and has also deployed a parachute and remains intact upon recovery.
Leo Hano Flight Profile
• Major Milestone Schedule (Project Initiation, Design, Manufacturing, Verification, Operations, and Major Reviews)

WCC’s major milestone schedule follows the USLI Timeline with the addition of our team’s specific events. The USLI Timeline we follow is out of the 2009-2010 University Student Launch Initiative Booklet. Our team specific events can be seen on the gantt plot. This gantt plot provides the team’s time line schedule for doing things, such as construction.

**WCC’s Major Milestone Schedule**

**August 2009:**
14 Request for proposal (RFP).
15 Sky Performance Rocket Club of Hawaii (SPRCH) launch at WCC

**September 2009:**
19 SPRCH launch at WCC

**October 2009:**
8 Completed proposal due to NASA MSFC.
17 SPRCH launch at WCC
29 Notification of selection.
30 USLI team teleconference

**November 2009:**
12 Web presence established for each team.
21 Hawaii Space Grant Consortium (HSGC) Presentation, SPRCH launch at WCC

**December 2009:**
4 Preliminary Design Review (PDR) report and PDR presentation slides due
14 PDR video conference.
19 Launch at Pacific Missile Range Facility (PMRF) and SPRCH launch at WCC,
   Stability testing of 3/8 scale model

**January 2010:**
16 SPRCH launch at WCC
20 Critical Design Review (CDR) report and CDR presentation slides due

**February 2010:**
1 Booster section completion
4 Critical Design Review presentations
14 avionic section complete
20 SPRCH launch at WCC, recovery deployment test
21 payload section and carrier completion
28 nose section completion
March 2010:
7 Kaneohe Marine Core Air Station (KMCAS) full scale test launch
17 Flight Readiness Review (FRR) report and FRR presentation slides due
20 SPRCH launch at WCC
25-Apr. 2 FRR presentations (tentative)

April 2010:
14 Travel to Huntsville
15 or 16 Rocket Fair/hardware and safety check
17-18 Launch weekend
19 Return home

May 2010:
7 Post-Launch Assessment Review (PLAR)
21 Announcement of winning USLI team
Nose Section

The nosecone is a standard 1:4.25 ratio ogive, having an outer diameter of 4", a shoulder length of 4", and made of fiberglass. A plywood centering ring, having a 2.25" inner diameter hole, is to be fitted to fit just inside the shoulder of the nose cone, and permanently epoxied in place. Here, as in all other places that call for epoxy, we are using two-part, 3 ton, slow cure epoxy. A circular plywood bulkhead, having a 2" X 8" electronic mounting board epoxied perpendicular to its surface, is to be attached to the fixed centering ring via 4 hex-head bolts and accompanying barrel nuts (the barrel nuts will be epoxied in place on the inside of the centering ring). This will allow the removal, preparation, and installation of the GPS/transceiver assembly required for the public address voice-over system.
Payload Section and Student Payload Carrier

The primary purpose of this section (and indeed for the entire rocket) is to carry the student payload carrier. The carrier, with its lid, would be given to the students prior to the launch date. On the launch date, the students would return the carrier (with their experiment in it) to the rocket preparation crew, who would then integrate it into the rocket. Once the student payload carrier is inserted into this section, the nose section would then be inserted on top of the payload carrier lid, and held in place by means of 3 nylon screws (which are not shown). This section consists of a 19" long, G-10 tube, with a circular ¼" thick plywood bulkhead epoxied into it. This section is attached to the rest of the rocket by a shock cord, which is mounted to the bulkhead via an eyebolt. The shock cord is also attached to the avionics section, and is where the drogue chute would be attached.
Avionics Section

The main purpose of this section is to carry the on-board recovery electronics (Avionics). The center section consists of the avionics bay that will contain the necessary electronics. The bay consists of a 6” long coupler tube, epoxied into place within the body tube of the rocket. Also epoxied to the coupler tube, as well as to the body tube, is a circular plywood bulkhead having a center-mounted eyebolt. The shock cord, associated with the main chute and connecting this part of the rocket to the booster section, is attached at this eyebolt. Another circular plywood bulkhead, also with a center mounted eyebolt, is attached to the other end of the avionics bay by means of three ¼” X 7” long bolts and associated wing-nuts. This bulkhead will be removable for access to the avionics section, and is where the shock cord to payload section is attached. Both plywood bulkheads will have to have holes placed for the pyro charge wires to
pass through (not shown). Also not shown is the ½” diameter hole that is to be drilled thru the body tube/ coupler into the avionics bay, for the pressure sensor to equalize with ambient.

**Booster Section**

This section contains the motor, and is constructed using a thru-the-wall construction. What is not shown is the motor casing, with its threaded cap. It is at the cap where the final eyebolt is placed. This is where the shock cord joining the avionics section, and associated with the main chute, is attached.
Brake/Shoe Assembly

Detail: Brake/Shoe Assembly
This is a detail diagram of the air-brake assembly showing the mounting, and subsequent deployment of the proposed air-brake. As can be inferred, this is simple in use; a standoff screw is to be adjusted to a proper deployment angle before flight. This acts to keep a half-cylindrical shoe at a fixed angle away from the rocket body. The resulting drag will reduce the overall expected altitude of the rocket. It is expected that the deployment angle shall be less then 30°.

A simple approach to estimating the enhancement of drag force, acting on the rocket by the deployment of the air-brake can be found. Take the geometry of a deployed brake to be that of a half cylinder (of radius $r$, just slightly larger then that of the rocket, and having a length $l$) canted at an angle of $q$ to that of the rocket body. By comparing the drag force utilizing a deployed brake ($FD = \frac{1}{2} r CD AD v^2$, where $AD = p r^2 \{1 + (2l/r) \sin q\}$) to that of the un-deployed situation ($FD = \frac{1}{2} r CD Ao v^2$, where $Ao = p r^2$) at the same speed, we find that the drag force...
is enhanced by a factor of \((1 + b \sin q)\), where \(b = 6\) for our design. A plot of this factor versus deployment angle results in a concave down curve that is fairly linear for the first 40\(^\circ\). Subsequent testing, using the 3/8\(^{th}\) scale, rocket showed a loss in altitude corresponding to \(~1\%\) for every degree of deployment. It is hoped that with a proper choice in motor, one yielding an altitude less than 30\% over the height, and a judicious adjustment in deployment angle, the desired altitude of 5280 feet can be obtained.

Preliminary Motor Selection
The preliminary motor selection for the Leo Hano rocket was determined through simulations with RockSim. Below are graphs of the data we collected.

Motors with a “c” before them are motors made by Cesaroni, while motors with an “a” before them are motors made by Aerotech.

The variables that were taken into consideration in this motor selection process was the motor size and potential student payload mass. We needed a motor that got the rocket as close to 5820 feet as possible, while still going over 5820 feet. Also, the maximum altitude could not be above 6864 feet, because we would not be able to achieve the desired altitude of 5820 feet, even with our braking system fully deployed at 30\(^{\circ}\).
Altitude vs Payload Mass (in kilograms) - using K engines

Altitude vs Payload Mass (in kilograms) - using K & L engines

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• Demonstrate that the design can meet all system level functional requirements.
  
  The overall design was based on previous methods that have been shown to be stable. Booster design, payload design, avionics section design have been based on the WCC Ho‘ola ARLISS (A Rocket for International Student Satellites) rocket. The nose section was based on the design given to us at the USLI workshop.

• Specify approach to workmanship as it relates to mission success.
  
  Using the appropriate personal protective equipment needed for construction/and or fabrication of parts team members will work in pairs to check and double check parts fabrication and or placement.

• Discuss planned additional component testing, functional testing, or static testing.
  
  3/8 scale testing will continue to determine the actual deployment angle to be used for the full scale rocket. Full scale flight tests are planned to verify the data results determined by the 3/8 scale tests. Full scale test flights will be conducted using lower powered motors to keep with in the 2500 foot limit imposed by KMCAS (Kaneohe Marine Corps Air Station). This test is tentatively scheduled for March 7, 2010, pending air operations approval.

  Recovery System testing is planned for February 20, 2010 at WCC. Black powder amount used for chute deployment as well as actual chute testing will be done on ground. Avionics electronics testing are also planned to be done on ground as well as in flight. GPS and Data acquisition electronics tests are also planned for this time.

• Status and plans of remaining manufacturing and assembly
  
  Parts for the full size rocket are on order. Avionics electronics and chutes have arrived. GPS and Data acquisition components are on order.

**Recovery Subsystem**

• Suitable parachute size for mass, attachment scheme, deployment process, test results with ejection charge and electronics
  
  Decent rate for the 3’ drogue chute was calculated using RockSim, at 60ft/sec while the 8’ main deployed at 500’ descends at less than 20ft/sec. All components will be tethered using 1’ tubular Kevlar. The rocket will be recovered as a single unit with no separated components.

  Primary chute deployment will be controlled by a G-Wiz HCX flight computer, drogue to be deployed at apogee, main to be deployed at 500’. Back-up chute deployment will be from a Perfect Flight MAWD set to deploy the drogue at apogee and main at 500’. Separate power systems and e-matches for both units.
• Safety and failure analysis

Seoul the G-Wiz HCX fail to deploy its chutes the Perfect Flight MAWD will act as a redundant deployment system.

Recovery Avionics Block Diagram

Mission Performance Predictions
• State the mission performance criteria.

• Payload functions properly
• Successful recovery the rocket and all its components
• Both parachutes deployed
• The rocket is completely intact
• The data is downloadable via EEPROM
• The voice-over performs it programmed duties (public is addressed)
• The subcontracted payload performed as it was planned to
The appropriate levels of safety are maintained throughout the entire process of preparation, launch, flight, and recovery of the rocket. To achieve any type of success in the mission, the rocket must have deployed a parachute and must be intact upon recovery, meaning it has the ability to be considered flight ready and meets all safety requirements without any repairs done. If the team does not have a parachute deployment and the rocket is not intact upon recovery, the mission will be considered a failure. A partially successful mission will be defined as meeting 6 of the 8 criteria, and has also deployed a parachute and remains intact upon recovery.

- Show flight profile simulations, altitude predictions with real vehicle data, component weights, and actual motor thrust curve.

Flight profile simulations have been addressed in the preliminary motor selection section. The motor that we have chosen is the Aerotech K560W.

Manufacturer: **AeroTech**
Entered: May 25, 2006
Last Updated: Apr 1, 2008
Mfr. Designation: K560W
Brand Name: K560W
Common Name: K560
Motor Type: reload
Diameter: 75.0mm
Length: 39.6cm
Total Weight: 2744g
Prop. Weight: 1425g
Cert. Org.: Tripoli Rocketry Association, Inc.
Cert. Designation: K590 (88%)
Cert. Date:
Average Thrust: 560.0N
Maximum Thrust: 753.7N
Total impulse: 2417.0Ns
Burn Time: 4.1s
Isp: 179s
Case Info: 75/2560
Propellant Info: White Lightning

Data provided by thrustcurve.org
**Payload Integration**

Ease of integration

- Describe integration plan
  
  As per the ARLISS events a payload canister will be given to schools to place their projects in. The projects must be able to fit with in the dimensions of the canister, 8 ¼” x 3 ½”, with the lid closed, and weigh no more than 1 kg. If it fits, it flies.
  
  Once the project has been loaded into the payload canister the canister is attached to the rocket, via Kevlar tether, and inserted into the payload section. The nosecone is then attached, and joined to the payload section using three nylon shear pins.

**Safety and Environment (Vehicle)**

- Identify Safety Officer for your team.

The safety officer for WCC’s team is Dr. Jacob Hudson.

- Update the Preliminary analysis of the failure modes of the proposed design of the rocket, payload integration and launch operations, including proposed and completed mitigations.

  This has been addressed in the mission criteria section.

- Update the listing of personnel hazards, and data demonstrating that Safety Hazards have been researched (such as Material Safety Data Sheets, operator’s manuals, NAR regulations), and that hazard mitigations have been addressed and mitigated.

  Material Safety Data Sheets: Refer to Appendix A (page 35)

  NAR Regulations: Refer to Appendix B (page 137)

  Hazard Mitigations: Refer to Appendix C (page 143)
IV) Payload Criteria

Payload Summary

● Summarize experiment

Mynah Bird 2 is an electronic package that will measure the current air temperature, air pressure and acceleration during the descent phase of a model rocket flight and stores this data in an EEPROM for later retrieval.

● Changes made to Payload Criteria

   ● This is a new project.

I) Payload Integration

● Describe integration plan with an understanding that the payload must be co-developed with the vehicle, be compatible with stresses placed on the vehicle and integrate easily and simply.

   ● Mynah Bird 2 will be built under the following limits:
     o Mass - 500 grams (17.63 ounces)
     o Diameter- 72 mm (2.83 or 2-13/16 inches)
     o Length - 203 mm (8 inches)
   ● While it is built and designed as a CanSat it will not be ejected from the Leo Hano rocket.
   ● There is a need for a hole in the payload bay of the Leo Hano rocket such that it will possible to gather accurate air pressure and temperature data.

Safety and Environment (Vehicle)

Payload integration and launch operations, including proposed and completed mitigations.

II) Payload Criteria

Selection, Design, and Verification of Payload Experiment

● Review the design at a system level, going through each system's functional requirements. (Includes sketches of options, selection rationale, selected concept and characteristics.)

   ● Devices in the project were selected based on price, availability of parts and vendor documentation.
   ● The sensors selected do not need any calibration.
• Describe the payload subsystems that are required to accomplish the payload objectives.

• Basic Stamp 2p (Parallax) – controller for the project

• Support
  - 24LC256 or 24LC512 (Microchip) – 32Kbyte or 64 Kbyte EEPROM for data storage on I²C data bus
  - DS1302 (Dallas Semiconductor) – Time keeper device on SPI data bus
  - MCP3204 (Microchip) – 4 channel A/D converter on SPI data bus
  - DIP switches – input
  - LED – status
  - Serial I/O port – data transfer

• Sensors:
  - MMA7455L (Freescale Semiconductor) – 3 Axis +/- 8g accelerometer on I²C data bus
  - LM34 or LM35 (National Semiconductor) – Temperature sensor connected to MCP3204
  - DS1620 (Dallas Semiconductor) – Temperature sensor on SPI data bus
  - MPX5100 or MPX4100 (Freescale Semiconductor) – Air Pressure sensor connected to MCP3204

• Power supply choices
  - 4xAA – 6 volts for a mission lasting over a hour
● Describe the performance characteristics for the system and subsystems and determine the evaluation and verification metrics.

● Mynah Bird 2 has not been constructed yet.

● Describe the verification plan and its status.

● Unit #1 will be constructed on a commercially available development board; this would help with debugging controller code and device hookups. This work hasn’t started yet but all the parts for this unit are available.

● Unit #2 will be constructed on a breadboard and to make sure the power supply chosen will perform the function. The phase will not occur until there are no device hookup changes in unit #1. All parts for this unit are available.

● Unit #3 will be constructed on a circuit board which will be the actual unit that will fly in the Leo Hano rocket. Some parts for this unit need to be purchased.

● Describe preliminary integration plan

  ● Setup controller, EEPROM, DIP switches and LED
  ● Setup the MMA7455L accelerometer
  ● Setup the DS1302 time keeper
  ● Setup the DS1620 temperature sensor
  ● Setup the MCP3204 A/D convertor
  ● Setup the LM34/LM35 temperature and MPX5100/MPX4100 air pressure sensors

● Determine the precision of instrumentation, repeatability of measurement and recovery system

  ● Will be using a 12 bit Analog to Digital (A/D) convertor to support the air pressure and temperature sensors.

Payload Concept Features and Definition

● Creativity and originality

  ● Mynah Bird 2 while is based on earlier projects, the overall coding of the mission and parts used in this project are new.
Mynah Bird from the 2007 AAS/AIAA CanSat Competition in terms of types of measurements it will be gathering.

- Passenger Board 2 from the 2009 ARLISS in terms of operational modes.

**Uniqueness or significance**

- Mynah Bird 2 modes of operation based on DIP switch settings
  - Mission mode – On power up at this setting Mynah Bird 2 will gather data from the sensors and store this information on the EEPROM provided that the Safety mode switch is on at startup
  - Setup mode – On power up at this setting and with a computer connected to it's serial I/O port it display a menu of available options which will allow the user to:
    - Dump the EEPROM contents to a computer display (the computer will capture the output to a file).
    - Test each sensor individually.
    - Run a short term mission
  - Safety mode – When enabled it will allow Mynah Bird 2 to write data at the start location of the EEPROM. When disabled Mynah Bird 2 will go into a shutdown mode and will not write data to the EEPROM

**Suitable level of challenge**

- Have used the Basic Stamp 2p controller, DS1620 and LM34 temperature sensors and the 24LC256 EEPROM in other projects before.
- Haven’t used multiple devices on the same SPI data bus or I²C data bus before.
- Haven’t integrated a project into custom designed printed circuit board before.

**Science Value**

- **Describe Science Payload Objectives.**

  - Accelerometer will be used to determine the forces acting on the rocket during its descent stage of the flight.
  - Air pressure will be used to help determine altitude of a rocket in flight
  - Air temperature will be used to help verify air pressure readings

- **State the payload success criteria.**
Critical Design Review Report

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- Complete Success – Mynah Bird 2 returns intact and all data from the sensors have been retrieved.
- Success – Mynah Bird 2 returns intact but data from some of the sensors have been retrieved.
- Minimal Success – Acceleration data has been recovered
- Disappointment – Mynah Bird 2 returns but no data has been recovered.
- Set Back – Mynah Bird 2 returns with damage such that it can not be repaired at the launch site
- Complete Failure – Mynah Bird 2 is lost and no data has been recovered.

- Describe the experimental logic, approach, and method of investigation.
  - Will compare temperature readings between the DS1620 temperature sensor and one of the LM34/LM35 temperature sensor in the same area of the project.

- Describe test and measurement, variables and controls.
  - Will use canned air to test temperature sensors.
  - Using an elevator in a 17 story building to test the air pressure sensor.
  - Test flights on a model rocket.

- Show relevance of expected data, accuracy/error analysis.
  - Will compare results of recovered acceleration and air pressure data against simulated projections from either Rocksim or RASP.

- Describe the Preliminary Experiment process procedures.
  - Will need to generate RASP or Rocksim simulations based on the final build of the Leo Hano rocket and the model rocket test.

Safety and Environment (Payload)
- Identify Safety Officer for your team.
  - Helen Rapozo for the building and testing phase.

- Provide a Preliminary analysis of the failure modes of the proposed design of the rocket, payload integration and launch operations, including proposed and completed mitigations.
  - Since Mynah Bird 2 remains inside the Leo Hano throughout the entire flight it shares its fate with that rocket.
• If the Leo Hano spends too much time on the launch pad the either the battery needs to be replaced or the amount of events Mynah Bird 2 can record has exceed its limit.

• Provide a listing of personnel hazards, and data demonstrating that Safety Hazards have been researched (such as Material Safety Data Sheets, operator’s manuals, NAR regulations), and that hazard mitigations have been addressed and mitigated.

• Canned airs – do not use it in confined spaces and make sure that people don’t touch surfaces after it has been sprayed upon.

• Discuss any environmental concerns.

  • Updated parts list after the unit has been constructed.
  • Will be using alkaline batteries as the power source.
  • The outer shell of Mynah Bird 2 will use a paper tube and balsa bulkheads.
APPENDICES
Nosecone Detail
Booster Detail
Drag Shoe Detail
All resistors shown are J-Tec electronic Matches
Pyro #1 consists of 3g Black powder
Pyro #2 consists of 4g Black powder
All switches are of the Rotary type

Recovery Avionics Block-diagram
Leo Hano Flight Profile
Appendix A: Material Safety Data Sheets (MSDS)

BUEHLER LTD -- 20-3100 PHENOLIC POWDER-BLACK -- 9330-00-166-0250

Product ID:20-3100 PHENOLIC POWDER-BLACK
MSDS Date:01/01/1985
FSC:9330
NIIN:00-166-0250
MSDS Number: BDDZJ

Company Name:BUEHLER LTD
Address:41 WAUKEGAN RD
City:LAKE BLUFF
State:IL
ZIP:60044-1687
Country:US
CAGE:09410

Product Identification

Company Name:BUEHLER LTD.
Address:41 WAUKEGAN RD.
City:LAKE BLUFF
State:IL
ZIP:60044-1687
Country:US
Phone:847-295-8500
CAGE:09410

Composition/Information on Ingredients

Ingred Name:PHENOL
CAS:108-95-2
RTECS #:SJ3325000
Fraction by Wt: 3%
OSHA PEL:S, 5 PPM
ACGIH TLV:S, 5 PPM; 8990
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

Ingred Name:NON HAZARDOUS INGREDIENTS (AS SPECIFIED BY MFR)
Fraction by Wt: 97%

Hazards Identification
Effects of Overexposure: NONE SPECIFIED BY MFR. POSS. SKIN, EYE, RESPIRATORY IRRIT DUE TO DUST

================================ First Aid Measures

First Aid: SKIN: WASH W/ SOAP & WATER. EYES: FLUSH W/ WATER FOR 15 MIN. AVOID INGESTION. CONSULT A DR.

================================ Fire Fighting Measures

Extinguishing Media: DRY CHEMICAL, WATER, CARBON DIOXIDE
Fire Fighting Procedures: SELF CONT BREATHING GEAR IN ENCLOSED AREA
Unusual Fire/Explosion Hazard: AVOID DUST ACCUMULATIONS OR DUST-LADEN ATMOSPHERES - DUST/AIR MIXTURES ARE EXPLOSIVE

================================ Accidental Release Measures

Spill Release Procedures: VACUUM OR SWEEP WITH SAWDUST, SAND OR SWEEPING COMPOUND. AVOID GENERATING DUST.

================================ Handling and Storage

Handling and Storage Precautions: AVOID TEMP EXTREMES & MOISTURE - CAN AFFECT PRODUCT PERFORMANCE. AVOID PROLONGED OR REPEATED SKIN & EYE CONTACT OR BREATHING OF VAPORS.
Other Precautions: USE ADEQUATE VENTILATION. USE GOOD PERSONAL HYGIENE.

================================ Exposure Controls/Personal Protection

Respiratory Protection: NIOSH APPROVED RESPIRATORS RECOMMENDED FOR NUISANCE DUST
Ventilation: LOCAL RECOMMENDED TO REMOVE DUST & FUMES
Protective Gloves: RECOMMENDED
Eye Protection: SAFETY GLASSES
Other Protective Equipment: AS NECESSARY FOR GOOD HYGIENE & CLEAN WORK
  ENVIRONMENT.
Supplemental Safety and Health EXPLOSIVE LIMITS (AS POWDER) EQUALS 0.030 OZ/CU FT.

================================== Physical/Chemical Properties ======================

HCC:T3  
NRC/State Lic Num: EXPLOSIVE LIMIT  
Boiling Pt: B.P. Text: NONE  
Solubility in Water: NEGLIGIBLE  
Appearance and Odor: GRANULAR-SLIGHT PHENOLIC ODOR.

================================== Stability and Reactivity Data =====================

Stability Indicator/Materials to Avoid: YES  
NONE SPECIFIED BY MFR  
Hazardous Decomposition  
Products: CO₂, CO, PHENOLS, AMMONIA, FORMALDEHYDE

================================== Disposal Considerations ==========================

Waste Disposal Methods: BURY OR INCINERATE IN ACCORDANCE WITH LOCAL, STATE OR FEDERAL REGS.

Disclaimer (provided with this information by the compiling agencies):
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CHEMRAY COATING CORP -- VARNISH, SPAR, PHENOLIC RESIN -- 8010-00-251-6980

============== Product Identification ===============

Product ID: VARNISH, SPAR, PHENOLIC RESIN
MSDS Date: 10/27/1989
FSC: 8010
NIIN: 00-251-6980
MSDS Number: BHVZW

=== Responsible Party ===
Company Name: CHEMRAY COATING CORP
Address: 209 N MICHIGAN AVE
City: KENILWORTH
State: NJ
ZIP: 07033
Country: US
Info Phone Num: 201-245-1111
Emergency Phone Num: 800-424-9300 (CHEMTREC)
Preparer's Name: FRED ARMSTRONG
CAGE: 33832

=== Contractor Identification ===
Company Name: CHEMRAY COATING CORP
Address: 209 N MICHIGAN AVE
Box: City: KENILWORTH
State: NJ
ZIP: 07033
Country: US
Phone: 201-245-1111
CAGE: 33832

============== Composition/Information on Ingredients ===============

Ingred Name: STODDARD SOLVENT
CAS: 8052-41-3
RTECS #: WJ8925000
Fraction by Wt: 41%
OSHA PEL: 500 PPM
ACGIH TLV: 100 PPM; 9293

Ingred Name: VOC=3.07 LBS/GAL OR 368 GRAMS/LITER
RTECS #:9999999VO

================================== Hazards Identification ==================================

Routes of Entry: Inhalation:YES  Skin:NO  Ingestion:NO
Health Hazards Acute and Chronic:OVEREXPOSURE-NAUSEA, HEADACHE, DIZZINESS CAUSED BY OVER INHALATION. HIGH VAPOR CONCENTRATIONS (>1000 PPM) ARE IRRITATING TO THE EYES AND RESPIRATORY TRACT, ARE ANESTHETIC, AND MAY HAVE OTHER CENTRAL NERVOUS SYSTEM EFFECTS. Effects of Overexposure:OVEREXPOSURE-NAUSEA, HEADACHE, DIZZINESS CAUSED BY OVER INHALATION. HIGH VAPOR CONCENTRATIONS (>1000 PPM) ARE IRRITATING TO THE EYES AND RESPIRATORY TRACT, ARE ANESTHETIC, AND MAY HAVE OTHER CENTRAL NERVOUS SYSTEM EFFECTS. Medical Cond Aggravated by Exposure:NONE GENERALLY KNOWN.

================================== First Aid Measures =====================================

First Aid:EYE CONTACT: FLUSH WITH WATER 15 MINUTES OR UNTIL IRRITATION SUBSIDES. IF IRRITATION PERSISTS, CALL PHYSICIAN. SKIN CONTACT: REMOVE CONTAMINATED CLOTHING AND WASH THOROUGHLY WITH SOAP AND WATER. INHALATION: IF OVERCOME BY VAPORS. REMOVE TO FRESH AIR, CALL PHYSICIAN. INGESTION: DO NOT INDUCE VOMITING, CALL PHYSICIAN.

================================== Fire Fighting Measures ===============================

Flash Point Method:SCC
Flash Point:103 F/40 C
Autoignition Temp:473 F
Lower Limits:0.9
Upper Limits:7
Extinguishing Media:CARBON DIOXIDE, FOAM, WATER FOG OR DRY CHEMICAL.
Fire Fighting Procedures:USE AIR SUPPLIED BREATHING EQUIPMENT. COOL ENCLOSED CONTAINERS WITH WATER SPRAY. AVOID BREATHING
VAPORS OR FUMES.

Unusual Fire/Explosion Hazard: IF LEAK OR SPILL HAS IGNITED, USE WATER SPRAY TO DISPERSE THE VAPORS FROM FIRE FIGHTERS.

================== Accidental Release Measures ==================

Spill Release Procedures: REMOVE ALL IGNITION SOURCES. KEEP FROM HEAT, SPARKS AND OPEN FLAME. ADD ABSORBENT (SAND, EARTH, SAWDUST) TO SPILL. VENTILATE AREA (OPEN WINDOWS, DOORS). LARGE SPILL: KEEP FROM ENTERING SEWERS/WATERCOU RSES BY DIKING. ADVISE AUTHORITIES IF DOES ENTER.

Handling and Storage

Handling and Storage Precautions: STORE AWAY FROM IGNITION SOURCES, KEEP IN COOL, DRY, WELL VENTILATED AREAS. AVOID DIRECT SUNLIGHT AND EXTREME TEMPERATURES, HOT OR COLD.

Other Precautions: AVOID EYE, SKIN CONTACT, INHALATION &/OR INGESTION OF MISTS, SPRAY OR VAPORS. AVOID BREATHING SANDING OR BLASTING DUST.

================== Exposure Controls/Personal Protection =================

Respiratory Protection: USE HYDROCARBON VAPOR CANISTER OR SUPPLIED AIR RESPIRATOR IN CONFINED AREAS.

Ventilation: LOCAL EXHAUST: FACE VELOCITY 60FPM. SPECIAL: USE ONLY W/ADEQUATE VENTILATION. MECHANICAL: USE EXPLOSION PROOF EQUIPMENT.

Protective Gloves: CHEMICAL RESISTANT.

Eye Protection: SPLASH GOGGLES OR FACE SHIELD.

Other Protective Equipment: USE CHEMICAL RESISTANT APRON OR CLOTHING.

Supplemental Safety and Health

Physical/Chemical Properties
Boiling Pt: B.P. Text: 308F, 153C  
Melt/Freeze Pt: M.P/F.P Text: O F (-17.8C)  
Decomp Temp: Decomp Text: 600 F (316C)  
Vapor Pres: <10 @ 68 F  
Vapor Density: 4.8 @ 77 F  
Spec Gravity: .90 (H2O=1)  
Viscosity: C-F@77F G.H.  
Evaporation Rate & Reference: 0.09 (BUTYL ACETATE=1)  
Solubility in Water: NEGLIGIBLE  
Appearance and Odor: CLEAR CARAMEL LIQUID WITH SOLVENT ODOR.  
Percent Volatiles by Volume: 47.7

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid: YES  
CAN REACT WITH OXIDIZING MATERIAL WHEN HEATED TO DECOMPOSITION.  
Stability Condition to Avoid: HIGH TEMPERATURES.  
Hazardous Decomposition Products: CARBON MONOXIDE.

==================== Disposal Considerations ======================

Waste Disposal Methods: ASSURE CONFORMITY WITH APPLICABLE DISPOSAL  
REGULATIONS. DISPOSE OF ABSORBED MATERIAL AT AN APPROVED DISPOSAL  
SITE OR FACILITY. DISPOSE IN CONFORMITY WITH STATE AND FEDERAL  
REGULATIONS.

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AeroTech Division, RCS Rocket Motor Components, Inc.

Material Safety Data Sheet & Emergency Response Information

Prepared in accordance with 29 CFR § 1910.1200 (g)

Section 1. Product Identification

Copperhead™ igniter, FirstFire™ igniter, FirstFire Jr.™ igniter. These products contain varying percentages of Ammonium or Potassium Perchlorate, carbon black and carbon fibers dispersed in a flammable binder with lesser amounts of proprietary ingredients such as burn rate modifiers and a metal fuel.

Section 2. Physical Characteristics

Narrow copper foil strips or yellow wires coated with a small amount of black igniter composition on one end, little or no odor

Section 3. Physical Hazards

Igniters are flammable and may give off varying amounts of Hydrogen Chloride and Carbon Monoxide gas, soot and carbon fibers when burned.

Section 4. Health Hazards

Igniter coating may be hazardous in the case of ingestion, and may be toxic to kidneys, lungs and the nervous system. Symptoms may include respiratory irritation, skin irritation, muscle tightness, vomiting, diarrhea, abdominal pain, muscular tremors, weakness, labored breathing, irregular heartbeat, convulsions. Inhalation of large amounts of combustion products may produce similar but lesser symptoms as ingestion.

Section 5. Primary Routes of Entry
Ingestion, inhalation.

Section 6. Permitted Exposure Limits
None established for manufactured product.

Section 7. Carcinogenic Potential
None known.

Section 8. Precautions for Safe Handling
Keep away from flames and other sources of heat. Do not smoke within 25 feet of product. Do not ingest. Do not breathe combustion products. Keep in original packaging until ready for use.

Section 9. Control Measures
See section 8.

Section 10. Emergency & First Aid Procedures
If ingested, induce vomiting and call a physician. If combustion products are inhaled, move to fresh air and call a physician if ill effects are noted. For mild burns use a first aid burn ointment. For severe burns immerse the burned area in cold water at once and see a physician immediately.

Section 11. Date of Preparation or Revision
October 12, 2008

Section 12. Contact Information
AeroTech Division, RCS Rocket Motor Components, Inc.
2113 W. 850 N. St.
Cedar City, UT 84721
(435) 865-7100 (Ph)
(435) 865-7120 (Fax)
Email: customerservice@aerotech-rocketry.com
Web: http://www.aerotech-rocketry.com
Emergency Response: (800) 535-5053 (US), (352) 323-3500 (Int'l)
AeroTech Division, RCS Rocket Motor Components, Inc.

Material Safety Data Sheet & Emergency Response Information

Prepared in accordance with 29 CFR § 1910.1200 (g)

Section 1. Product Identification

Model rocket motor, high power rocket motor, hobby rocket motor, composite rocket motor, rocket motor kit, rocket motor reloading kit, containing varying amounts of solid propellant with the trade names White Lightning™, Blue Thunder™, Black Jack™, Black Max™, Redline™, Warp-9™ or Mojave Green™. These products contain varying percentages of Ammonium Perchlorate, Strontium and/or Barium Nitrate dispersed in synthetic rubber with lesser amounts of proprietary ingredients such as burn rate modifiers and metal fuels. Rocket motor ejection charges contain black powder.

Section 2. Physical Characteristics

Black plastic cylinders or bags with various colored parts, little or no odor

Section 3. Physical Hazards

Rocket motors and reload kits are flammable, rocket motors may become propulsive in a fire. All propellants give off varying amounts of Hydrogen Chloride and Carbon Monoxide gas when burned, Mojave Green propellant also produces Barium Chloride.

Section 4. Health Hazards

Propellant is an irritant in the case of skin and eye contact, may be extremely hazardous in the case of ingestion, and may be toxic to kidneys, lungs and the nervous system. Symptoms include
respiratory irritation, skin irritation, muscle tightness, vomiting, diarrhea, abdominal pain, muscular tremors, weakness, labored breathing, irregular heartbeat, convulsions. Inhalation of large amounts of combustion products may produce similar but lesser symptoms as ingestion.

Section 5. Primary Routes of Entry

Skin contact, ingestion, inhalation.

Section 6. Permitted Exposure Limits

None established for manufactured product.

Section 7. Carcinogenic Potential

None known.

Section 8. Precautions for Safe Handling

Disposable rubber gloves are recommended for handling Mojave Green propellant. Keep away from flames and other sources of heat. Do not smoke within 25 feet of product. Do not ingest. Do not breathe exhaust fumes. Keep in original packaging until ready for use.

Section 9. Control Measures

See section 8.

Section 10. Emergency & First Aid Procedures

If ingested, induce vomiting and call a physician. If combustion products are inhaled, move to fresh air and call a physician if ill effects are noted. In the case of skin contact, wash area immediately and contact a physician if severe skin rash or irritation develops. For mild burns use a first aid burn ointment. For severe burns immerse the burned area in cold water at once and see a physician immediately.

Section 11. Date of Preparation or Revision

October 11, 2008

Section 12. Contact Information
AeroTech Division, RCS Rocket Motor Components, Inc.
2113 W. 850 N. St.
Cedar City, UT 84721
(435) 865-7100 (Ph)
(435) 865-7120 (Fax)
Email: customerservice@aerotech-rocketry.com
Web: http://www.aerotech-rocketry.com
Emergency Response: (800) 535-5053 (US), (352) 323-3500 (Int'l)

EMS CATALOG NO: 13000
EMS PRODUCT: DER 736 Epoxy Resin
DATE: 03/06/96
PAGE NUMBER: One of 5

MATERIAL SAFETY DATA SHEET

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.

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ELECTRON MICROSCOPY SCIENCES
321 MORRIS ROAD
P.O. BOX 251
FORT WASHINGTON, PA 19034
24 HOUR EMERGENCY PHONE NUMBER
(215) 646-1566 CHEMTREC: (800) 424-9300

FOR PRODUCT AND SALES INFORMATION

Page 46 of 149
CONTACT ELECTRON MICROSCOPY SCIENCES OFFICE ABOVE.

PRODUCT IDENTIFICATION

PRODUCT NAME: D.E.R.(R) 736 Epoxy Resin

INGREDIENTS: Epichlorohydrin-polyglycol reaction product

(% w/, unless otherwise noted)

CAS NUMBER: 041638-13-5

PERCENT: 100

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

PHYSICAL DATA

BOILING POINT: Greater than 225°C at 760 mm Hg
VAPOR PRESSURE: 5.6 mm Hg at 20°C
VAPOR DENSITY: Not applicable
SOLUBILITY IN WATER: 11.0 wt.%
SPECIFIC GRAVITY: 1.14
VISCOSITY: 30-60 cps at 25°C
APPEARANCE: Near water white liquid
ODOR: Slight ethereal.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 320°F

METHOD USED: PMCC, ASTM D-93
FLAMMABLE LIMITS: LFL: Not determined  
UFL: Not determined  
EXTINGUISHING MEDIA:  
Foam, CO2, dry chemical, alcohol-resistant foam  
FIRE AND EXPLOSION HAZARDS: None known  
FIRE-FIGHTING EQUIPMENT: Wear positive pressure self-contained breathing apparatus.  

REACTIVITY DATA  

STABILITY (CONDITIONS TO AVOID):  
None; but for maximum product life do not exceed 55oC (131oF) during storage.  
INCOMPATIBILITY (SPECIFIC MATERIALS TO AVOID):  
Base or strong acid, amines and oxidizing materials.  
HAZARDOUS DECOMPOSITION PRODUCTS:  
The by-products expected in incomplete pyrolysis or combustion of epoxy resins are mainly phenolics, carbon monoxide, hydrogen chloride, and water. The thermal decomposition products of epoxy resins therefore should be treated as potentially hazardous substances, and appropriate precautions should be taken.  
HAZARDOUS POLYMERIZATION:  
Will not occur by itself, but masses of more than 1 pound of product plus an aliphatic amine will cause irreversible polymerization with considerable heat buildup.  

ENVIRONMENTAL AND DISPOSAL INFORMATION  

ACTION TO TAKE FOR SPILLS/LEAKS:
Soak up in absorbent material such as sand and collect in suitable containers. Residual resin may be removed using steam or hot soapy water. Solvents are not recommended for cleanup unless the recommended exposure guidelines and safe handling practices for the specific solvent are followed. Consult appropriate solvent MSDS for handling information and exposure guidelines. Keep spark producing equipment away. For large spills, evacuate upwind of spills and contain with dike.

DISPOSAL METHOD:

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. For unused or uncontaminated material, the preferred disposal options are to send to a licensed recycler, reclaimer, or incinerator. For used or contaminated material, the preferred disposal options remain the same, although additional evaluation is required (see, for example, 40 CFR, Part 261, "Identification and Listing of Hazardous waste.") Any disposal practice must be in compliance with Federal, State, Provincial, and Local laws and regulations.

HEALTH HAZARD DATA

EYE: May cause moderate irritation with corneal injury.

SKIN CONTACT:

Short single exposure not likely to cause significant skin irritation. Prolonged exposure may cause skin irritation. Repeated exposure may cause skin burns. May cause more severe response if confined to skin or skin is abraded (scratched or cut). May cause allergic skin reaction in susceptible individuals.

SKIN ABSORPTION:

A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The LD50 for skin absorption in rabbits is >2000mg/kg.

INGESTION:

Single dose oral toxicity is low. The oral LD50 for
rats is >2000 mg/kg. Amounts ingested incidental to normal handling operations are not likely to cause injury; swallowing larger amounts may cause injury.

INHALATION:

Elevated temperatures may generate vapor levels sufficient to cause irritation and other effects.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL):

Results of in vitro ("test tube") mutagenicity tests have been positive.

FIRST AID

EYES: Irrigate immediately with water for at least 15 minutes.

SKIN: Wash off in flowing water or shower.

INGESTION:

Induce vomiting if large amounts are ingested. Consult medical personnel.

INHALATION:

Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN:

If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgement of the physician in response to reactions of the patient.

HANDLING PRECAUTIONS

EXPOSURE GUIDELINE(S): None established.
VENTILATION:

Good general ventilation should be sufficient for most conditions.

RESPIRATORY PROTECTION:

No respiratory protection should be needed. If respiratory irritation is experienced, use an approved air-purifying respirator.

SKIN PROTECTION:

For brief contact, no precautions other than clean body-covering clothing should be needed. When prolonged or frequently repeated contact could occur, use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron or full-body suit will depend on operation.

EYE PROTECTION:

Use safety glasses. Where contact with this material is likely, chemical goggles are recommended because eye contact may cause pain even though it is unlikely to cause injury.

ADDITIONAL INFORMATION

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

None except normal handling care. Practice good caution and personal cleanliness to avoid eye and skin contact. Avoid breathing vapors if generated.
ITW DEVCON CORP -- 5-MINUTE EPOXY RESIN -- 8040-00-264-6816
================================ Product Identification =====================

Product ID: 5-MINUTE EPOXY RESIN
MSDS Date: 12/14/1989
FSC: 8040
NIIN: 00-264-6816
MSDS Number: BLJGZ

=== Responsible Party ===
Company Name: ITW DEVCON CORP
Address: 30 ENDICOTT ST
City: DANVERS
State: MA
ZIP: 01923
Country: US
Info Phone Num: 508-777-1100
Emergency Phone Num: 800-424-9300 CHEMTREC
CAGE: EO352

=== Contractor Identification ===
Company Name: DEVCON CORP
Address: 30 ENDICOTT ST
Box: City: DANVERS
State: MA
ZIP: 01923-3753
Country: US
Phone:1-508-777-1100
CAGE:16059
Company Name:ITW DEVCON CORP
Address:30 ENDICOTT ST
City:DANVERS
State:MA
ZIP:01923
Country:US
Phone:508-777-1100
CAGE:EO352

============== Composition/Information on Ingredients ===============

Ingred Name:BISPHENOL A DIGLYCIDYL ETHER RESIN (POTENTIAL SKIN SENSITIZER)
CAS:25068-38-6
RTECS #:KD4380000
Fraction by Wt: >60%
Other REC Limits:NONE SPECIFIED

Ingred Name:VOC: 0 LBS/GAL (EPA REFERENCE METHOD 24)
RTECS #:9999999VO
Other REC Limits:NONE SPECIFIED

==================== Hazards Identification =====================

LD50 LC50 Mixture:ORAL LD50 RAT: 11,400 MG/KG; DERM LD50 *
Routes of Entry: Inhalation:NO  Skin:YES  Ingestion:YES
Reports of Carcinogenicity:NTP:NO  IARC:NO  OSHA:NO
Health Hazards Acute and Chronic:PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE SENSITIZATION WITH ITCHING, SWELLING OR RASHES ON LATER EXPOSURE.
Explanation of Carcinogenicity:*RABB: >20,000 MG/KG; INHALATION LC50 RAT: NO DEATHS IN SATURATED AIR; EXPOSURE TIME: 8 HRS.
Effects of Overexposure:EYES: MILD IRRITATION. SKIN: MILD IRRITATION. INHALATION. THE LOW VAPOR PRESSURE OF THE RESIN MAKES INHALATION UNLIKELY IN NORMAL USE. INGESTION: ACUTE ORAL TOXICITY IS LOW. MAY CAUSE GASTRIC DISTRESS.
Medical Cond Aggravated by Exposure:ALLERGIES, ECZEMA OR OTHER SKIN DISORDERS.
First Aid Measures

First Aid: EYES: FLUSH W/CLEAN WATER-15 MIN. WHILE GENTLY HOLDING EYELIDS OPEN. GET IMMED MEDICAL ATTENTION. SKIN: WASH THOROUGHLY W/ SOAP & WARM WATER. CONSULT PHYSICIAN IF IRRIT DEVELOPS. INHALATION: REMOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS DIFFICULT. GET MEDICAL ATTENTION IF SYMPTOMS PERSIST. INGESTION: DO NOT INDUCE VOMITING. GIVE 2 GLASSES WATER TO DILUTE (UNLESS UNCONSCIOUS). GET MEDICAL ATTEN.

Fire Fighting Measures

Flash Point Method: PMCC
Flash Point: >400°F, >204°C
Lower Limits: N/D
Upper Limits: N/D
Extinguishing Media: CO2, DRY CHEMICAL, FOAM.
Fire Fighting Procedures: FIREFIGHTERS SHOULD WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING.
Unusual Fire/Explosion Hazard: NONE

Accidental Release Measures

Spill Release Procedures: PREVENT SKIN AND EYE CONTACT. LARGE SPILLS MAY BE ABSORBED ON INERT MATERIAL SUCH AS SAND OR VERMICULITE. SCRAPE SPILL UP INTO NONPOROUS CONTAINERS. CLEAN SPILL AREA WITH STRONG DETERGENT AND WATER; USE SOLVENTS ONLY WITH APPROPRIATE CAUTION.

Handling and Storage

Handling and Storage Precautions: STORE IN A COOL, DRY PLACE. HANDLE MIXED RESIN & HARDENER IN ACCORDANCE W/POTENTIAL HAZARD OF THE CURING AGENT USED. DISCARD CONTAMINATED LEATHER ARTICLES. Other Precautions: REMOVE CONTAMINATED CLOTHING AND PROTECTIVE GEAR;
CLEAN THOROUGHLY BEFORE USING AGAIN. IF CURED MATERIAL IS SANDED OR MACHINED, USE ADEQUATE PRECAUTIONS AGAINST NUISANCE PARTICULATES.

============== Exposure Controls/Personal Protection ===============

Respiratory Protection: NONE REQUIRED AT NORMAL HANDLING TEMPERATURES.
Ventilation: LOCAL EXHAUST IS RECOMMENDED FOR CONFINED AREAS. GENERAL MECHANICAL VENTILATION IS ADEQUATE FOR NORMAL USE.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: SAFETY GLASSES WITH SIDE SHIELDS.
Other Protective Equipment: OTHER GEAR AS REQUIRED.
Work Hygienic Practices: WASH THOROUGHLY AFTER USING, PARTICULARLY BEFORE EATING OR SMOKING.

Supplemental Safety and Health

============== Physical/Chemical Properties ===============

HCC:N1
Boiling Pt:B.P. Text:N/D
Melt/Freeze Pt:M.P/F.P Text:N/D
Vapor Pres:NIL @ 70 F
Vapor Density:>1
Spec Gravity:1.2
pH:7 (5%)
Evaporation Rate & Reference:<<1 (BUAC = 1)
Solubility in Water: NIL
Appearance and Odor: THICK, AMBER LIQUID WITH LITTLE ODOR.

============== Stability and Reactivity Data ===============

Stability Indicator/Materials to Avoid: YES STRONG ACIDS AND STRONG OXIDIZING AGENTS.
Stability Condition to Avoid: OPEN FLAME AND EXTREME HEAT.
Hazardous Decomposition Products: OXIDES OF CARBON, ALDEHYDES AND ACIDS FROM INCOMPLETE COMBUSTION.
Conditions to Avoid Polymerization: HEAT IS GENERATED WHEN THIS RESIN IS MIXED WITH AMINES OR EPOXY HARDENERS; BE CAREFUL WHEN MIXING.
==================== Disposal Considerations ====================

Waste Disposal Methods: REMOVE TO A WASTE FACILITY OPERATING IN COMPLIANCE WITH STATE AND LOCAL REGULATIONS.

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SPECIALTY COMPOUNDS INC -- SINMAST 4 EPOXY MORTAR MIX - NORMAL CURE -- 5610-00N078857

Product Identification

Product ID: SINMAST 4 EPOXY MORTAR MIX - NORMAL CURE
MSDS Date: 08/01/1995
FSC: 5610
NIIN: 00N078857
MSDS Number: CGGQS

=== Responsible Party ===
Company Name: SPECIALTY COMPOUNDS INC
Address: 3300 EAST 84TH PLACE
City: MERRILVILLE
State: IN
ZIP: 46410
Country: US
Info Phone Num: 219-947-1070
Emergency Phone Num: 800-255-3924
CAGE: 7T163

=== Contractor Identification ===
Company Name: SPECIALTY COMPOUNDS INC
Address: 3300 E 84TH PL
Box: City: MERRILLVILLE
State: IN
ZIP: 46410-6551
Country: US
Phone: 219-947-1070
CAGE: 7T163

=============== Composition/Information on Ingredients ===============

Ingred Name: COMPONENT "A" (CONSISTING OF INGREDIENTS 2 & 3)
RTECS #: 9999999ZZ
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: BISPHENOL A-EPICHLOROHYDRIN COPOLYMER;
(BISPHENOL A
EPICHLOROHYDRIN EPOXY RESIN)
CAS: 25068-38-6
RTECS #: SL6475000
Fraction by Wt: 90%
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: PROPANE, 1-BUTOXY-2,3-EPOXY-; (BUTYL GLYCIDYL ETHER)
(BGE)
CAS: 2426-08-6
RTECS #: TX4200000
Fraction by Wt: 10%
OSHA PEL: 50 PPM
ACGIH TLV: 25 PPM

Ingred Name: COMPONENT "B" (CONSISTING OF INGREDIENTS 5 - 8)
RTECS #: 9999999ZZ
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: TOFA REACT WITH TEPA
CAS: 68953-36-6
Fraction by Wt: 55%
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: DIETHYLENETRIAMINE
CAS: 111-40-0
RTECS #: IE1225000
Fraction by Wt: 15%
OSHA PEL: 1 PPM
ACGIH TLV: 1 PPM, S

Ingred Name: 1,2-ETHANEDIAMINE, N-(2-AMINOETHYL)-N’-(2-((2-AMINOETHYL)AMINO)ETHYL)-; (TETRAETHYLENEPENTAMINE)
CAS: 112-57-2
RTECS #: KH8585000
Fraction by Wt: 15%
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: PHENOL, 4,4’-ISOPROPYLENEDI-; (BISPHEROL A) (SARA 313)
CAS: 80-05-7
RTECS #: SL6300000
Fraction by Wt: 10%
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: SUPP DATA: WHEN PRODUCT COMES IN CONTACT WITH NITROUS ACID, NITRITES OR ATMOSPHERES W/HIGH NITROUS OXIDE CONCENTRATIONS.
RTECS #: 9999999ZZ

Ingred Name: SPILL PROC: OR DISP. EVACUATE ALL PERS UPWIND FROM SPILL.
PVNT SPILL PROD FROM ENTERING STREAMS/DRINKING WATER (ING 11)
RTECS #: 9999999ZZ

Ingred Name: ING 10: SUPPLIES. NOTIFY LOCAL HEALTH AUTHORITIES & OTHER APPROPRIATE AGENCIES IF SUCH CONTAMINATION SHOULD OCCUR.
RTECS #: 9999999ZZ

Ingred Name: PROT GLOVES: SITUATIONS, WEAR IMPERMEABLE GLOVES W/CUFFS TO PVNT SPREAD OF MATL ABOVE WRISTS. EXAMINE PROT GLOVES (ING 13)
RTECS #: 9999999ZZ

Ingred Name: ING 12: BEFORE USING. DISCARD IF THERE IS EVIDENCE OF HOLES OR CRACKS.
RTECS #:9999999ZZ

------------------------------- Hazards Identification -----------------------------

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:NO  Skin:YES  Ingestion:YES
Reports of Carcinogenicity:NTP:NO    IARC:NO    OSHA:NO
Health Hazards Acute and Chronic:EYE CONTACT:MODERATELY IRRITATING.

SKIN CONTACT:MODERATELY IRRITATING - POSSIBLE SENSITIZATION.
INHALATION:DUE TO LOW VOLATILITY, NOT LIKELY TO BE INHALED.
INGESTION:CAN CAUSE BLEEDING IN GASTROINTESTINAL TRACT.
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:SEE HEALTH HAZARDS.
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

------------------------------- First Aid Measures -----------------------------

First Aid: EYES: FLUSH W/PLENTY OF WATER FOR AT LST 15 MINS HOLDING LIDS
OPEN. GET MED ATTN. SKIN:REMOVE PROD FROM SKIN. FLUSH AFFECTED AREA
W/WATER. REMOVE CONTAM CLTHG & GLOVES. FOLLOW BY WASHING W/SOAP &
WATER . IF IRRIT PERSISTS GET MED ATTN. INHAL:REMOVE TO FRESH AIR &
PROVIDE OXYG IF BRTHG IS DFCLT. GET MED ATTN. INGEST:DO NOT INDUCE VOMIT.
ADMIN 3-4 GLASSES OF MILK/WATER. OBTAIN MED CARE IMMEDIATELY.

------------------------------- Fire Fighting Measures -----------------------------

Flash Point Method:PMCC
Flash Point:156F,69C
Extinguishing Media:WATER FOG, CO*2, DRY CHEMICAL OR FOAM.
MATERIAL WILL NOT BURN UNLESS PREHEATED.
Fire Fighting Procedures:USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT . COOL FIRE W/WATER FOG.
Unusual Fire/Explosion Hazard:NONE SPECIFIED BY MANUFACTURER.

------------------------------- Accidental Release Measures -----------------------------


Spill Release Procedures: SHUT OFF/REMOVE ALL IGNIT SOURCES. CONSTRUCT
   DIKE TO PVNT SPREADING. PERS SHOULD BE EQUIPPED W/ NIOSH APPRVD SCBA
   & BUTYL RUBBER PROT CLTHG. COVER MINOR SPILLS W/SODIUM BISULFITE &
   REDUCE VAPS. SPRAY W/WATER. PLACE IN METAL CNTNRS FOR RECOVERY(ING
   10)
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Handling and Storage

Handling and Storage Precautions: CORR. KEEP AT ROOM TEMP, DRY, VENTED
   STOR IN CLSD CNTNRS. KEEP AWAY FROM OXIDIZERS, HEAT/FLAMES. STORE
   IN STEEL CNTNRS. AVOID CONT W/SKIN OR EYES.
Other Precautions: HANDLE IN WELL VENTED WORK SPACE. AVOID BRTHG VAPS.
   ADHERE TO WORK PRACTICE RULES ESTABLISHED BY GOVT REGS (E.G. OSHA).
   DO NOT USE SODIUM NITRITE/OTHER NITROSATING AGENTS IN FORMULATIONS.
   CANCER-CAUSING NITROSAMINES COULD BE FORMED.

Exposure Controls/Personal Protection

Respiratory Protection: IN POORLY VENTED AREAS, A NIOSH APPRVD CARTRIDGE
   MASK APPRVD FOR ORG VAPS IS REC UNDER FOLLOWING CNDTN S: EMER
   SITUATIONS, WHEN PROD VAP CONC IS >20 PPM FOR PERIOD >15 MINS,
   DURING REPAIR & CLEANING OF EQUIP, DURING TRANSFER/DISCHARGE(SUPDAT)
Ventilation: ADEQUATE GENERAL & LOCAL EXHAUST.
Protective Gloves: NITRILE RUBBER GLOVES. IN EMER (ING 12)
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGS &(SUPDAT)
Other Protective Equipment: EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET
   ANSI DESIGN CRITERIA. LONG SLEEVE CLTHG, SLICKER SUIT, RUBBER
BOOTS.
Work Hygienic Practices: CONTACT LENSES SHOULD NOT BE WORN. WASH AT END
OF EACH WORK SHIFT & BEFORE EATING, SMOKING/USING TOILET.
LAUNDER (SUPDAT)
Supplemental Safety and Health
PH: ALKALINE. WASTE DISP METH: LONG TERM ENVIRON HAZS, THUS LANDFILL
DISPS MUST BE CONSIDERED LESS ACCEPT THAN INCIN. RESP PROT: & USE OF
PROD. EYE PROT: FULL LGTH FSHLD. HYGIENE PRACT: OR DISCARD CONTAM CLTHG.
DISCARD CONTAM LEATHER ARTICLES INCL SHOES. MATLS TO
AVOID: ARE KNOWN TO BE CARCINS, MAY BE FORMED (ING 9)

Physical/Chemical Properties
pH: SUPDAT
Appearance and Odor: CLEAR, LIGHT AMBER, FLOWABLE LIQUID; AMMONIACAL ODOR.

Stability and Reactivity Data
Stability Indicator/Materials to Avoid: YES CAN REACT VIGOROUSLY W/ STRONG OXIDIZING AGENTS, STRONG LEWIS/MINERAL ACIDS. CAUT: N-NITROSAMINES, MANY OF WHICH (SUPDAT)
Stability Condition to Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products: N-NITROSAMINES MAY BE FORMED.

Disposal Considerations
Waste Disposal Methods: COMPLY W/ ALL FED, STATE & LOC REGS. INCIN IS ACCEPT & PREF METH OF DISP. INCIN IN ADMIXT W/FUEL EQUIPPED W/SCRUBBER TO REMOVE NITROGEN OXIDES & CARBON MONOXIDE.
DISP OF IN
APPRVD LANDFILL IF ALLOWED LOCALLY. WASTE FROM THIS PROD MAY
PRESENT (SUPDAT)

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document should seek competent professional advice to verify and
assume responsibility for the suitability of this information to their
particular situation.

GARLOCK INC -- COMPRESSED CARBON FIBER SHEET, STYLE MTC-9850 -
- 5330-00N064992
================================ Product Identification ===============

Product ID:COMPRESSED CARBON FIBER SHEET, STYLE MTC-9850
MSDS Date:08/11/1993
FSC:5330
NIIN:00N064992
MSDS Number: BZKXB
=== Responsible Party ===
Company Name:GARLOCK INC
Address:1666 DIVISION ST
City:PALMYRA
State:NY
ZIP:14522
Country:US
Caging
Design Review

Windward Community College – University of Hawaii 2009-2010

Info Phone Num:315-597-4811
Emergency Phone Num:315-597-4811
Preparer's Name:Harold R Hughes
CAGE:76380

Company Name:Garlock Inc
Address:1666 Division St
Box:Palmyra
State:NY
ZIP:14522
Country:US
Phone:315-597-4811
CAGE:76380

Company Name:Garlock Inc Mechanical Packing Div
Address:1666 Division St
City:Palmyra
State:NY
ZIP:14522-9343
Country:US
Phone:315-597-4811
CAGE:73680

============== Composition/Information on Ingredients ===============

Ingred Name:Mineral Wool; (Rock Wool (Man made Mineral Fiber))
RTECS #:PY80700000
Fraction by Wt: 2-6%
OSHA PEL:N/K
ACGIH TLV:10 mg/m3 (TWA) (MFR)

Ingred Name:Silica, Crystalline - Quartz (Crystalline Silica - Not A
HAZARD UNLESS AIRBORNE)
CAS:14808-60-7
RTECS #:V7330000
Fraction by Wt: <2.5%
OSHA PEL:SEE TABLE Z-3
ACGIH TLV:0.1 mg/m3 RDUST;9495

Ingred Name:Graphite; (Natural Graphite - NOT A HAZARD UNLESS
AIRBORNE)
CAS:7782-42-5
RTECS #:MD9659600
Fraction by Wt: 2-5%
OSHA PEL:15 MPPCF; Z-3
ACGIH TLV: 2 MG/M3 RDUST; 9495

Ingred Name: FIBERS, SYNTHETIC; (SYNTHETIC FIBERS)
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: BINDER SYSTEM; (ELASTOMERIC BINDERS)
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: STYRENE-BUTADIENE; (STYRENE-BUTADIENE ELASTOMER)
OSHA PEL: N/K
ACGIH TLV: N/K

----------------------------- Hazards Identification -----------------------------

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation: YES  Skin: NO  Ingestion: NO
Reports of Carcinogenicity: NTP: YES  IARC: YES  OSHA: NO
Health Hazards Acute and Chronic: PRODUCT DOES NOT POSE A HEALTH HAZARD
   UNDER ORDINARY CONDITIONS OF USE. A HAZARD WOULD ARISE ONLY IF THE
   PRODUCT WAS SUBJECT TO MECHANICAL ACTIONS WHICH COULD CAUSE FIBERS
   AND/OR DUST TO RELEASED FROM THE ELASTOMER MATRIX.
   INHALATION OF
   SUFFICIENT QUANTITIES OF FIBERS AND/OR DUST COULD CAUSE
   (EFTS OF
   OVEREXP)
Explanation of Carcinogenicity: CRYSTALLING SILICA: NTP 7TH ANNUAL RPT ON
CARCINS, 1994: ANTIC TO BE CARCIN. IARC MONOGRAPHS, SUPP. VOL 7, PG
341(SUPDAT)
Effects of Overexposure: HLTH HAZ: RESPIRATORY PROBLEMS AND HAS THE
   POTENTIAL TO CAUSE LASTING LUNG DAMAGE.
Medical Cond Aggravated by Exposure: BREATHING AIRBORNE FIBERS OR
PARTICULATES MAY AGGRAVATE ANY EXISTING LUNG DISORDERS OR BRONCHITIS.

------------------------------- First Aid Measures -------------------------------
First Aid: INGEST: CALL MD IMMEDIATELY. EYES: IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD.

SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD.

INHAL: IF OVERCOME BY THERMAL DECOMPOSITION PRODUCTS FROM A FIRE, MOVE TO FRESH AIR.

IF VICTIM IS UNCONSCIOUS, EXHIBITS BREATHING DIFFICULTY OR IF RECOVERY IS NOT PROMPT, CONTACT A PHYSICIAN FOR TREATMENT.

====================  Fire Fighting Measures  =====================

Extinguishing Media: WATER, FOAM, CARBON DIOXIDE, DRY CHEMICAL.
Fire Fighting Procedures: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT.

Unusual Fire/Explosion Hazard: PRODUCES SMOKE AND SOME HAZARDOUS DECOMPOSITION PRODUCTS WHEN BURNED.

==================  Accidental Release Measures  ===================

Spill Release Procedures: NO SPECIAL ACTION FOR SOLID PIECES OF PRODUCT.

VACUUM UP ANY DUST FROM OPERATIONS SUCH AS GASKET CUTTING.

ALTERNATELY, DAMPEN AREA BEFORE WIPING OR SWEEPING. DO NOT DRY WIPE OR SWEEP.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

======================  Handling and Storage  =======================

Handling and Storage Precautions: STORE IN CLEAN DRY PLACE AWAY FROM STRONG OXIDIZING AGENTS. DO NOT GRIND OR MACHINE PRODUCT.

NORMAL WASH UP AFTER HANDLING IS RECOMMENDED.

Other Precautions: WHEN REMOVING USED GASKETS, AVOID EXCESSIVE MECHANICAL ACTIONS AND PLACE RESIDUE IN A PLASTIC BAG FOR DISPOSAL.

==============  Exposure Controls/Personal Protection  ===============
Respiratory Protection: NO SPECIAL REQUIREMENTS UNDER NORMAL CONDITIONS OF USE. HALF-FACE RESP W/HIGH EFFICIENCY FILTERS SHOULD BE WORN BY INDIVIDUALS WHEN ENGAGING IN REMOVAL OF USED GASKETS THAT ARE FRIABLE/WHICH REQ AGGRESSIVE SCRAPING & WIRE BRUSHING TO REMOVE.

Ventilation: NO SPECIAL REQUIREMENTS UNDER NORMAL CONDITIONS OF USE.

Protective Gloves: IMPERVIOUS GLOVES.

Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS.

Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.

Work Hygienic Practices: NO SPECIAL RECOMMENDATIONS.

Supplemental Safety and Health

EXPLAN OF CARCIN: 1987: GROUP 2A. ANIMAL: LUNG. HAZ DECOMP PROD:
HYDROGEN CYANIDE. THERE MAY BE OTHERS UNKNOWN TO US.

Physical/Chemical Properties

Solubility in Water: INSOLUBLE

Appearance and Odor: BLACK SHEET OR GASKETS - SLIGHT ODOR.

Stability and Reactivity Data

Stability Indicator/Materials to Avoid: NO AVOID STORAGE WITH STRONG OXIDIZING AGENTS.

Stability Condition to Avoid: DIRECT FLAME WILL IGNITE PRODUCT.

Hazardous Decomposition Products: IN A FIRE: CARBON MONOXIDE UNDER CERTAIN CIRCUMSTANCES, POSSIBLY ACRYLONITRILE MONOMER FUMES AND POSSIBLY SOME (SUPDAT)

Disposal Considerations

Waste Disposal Methods: NORMAL LANDFILL. COMPLY WITH ANY LOCAL DISPOSAL REGULATIONS. DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

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CLARK-SCHWEBEL FIBER GLASS CORP -- FIBER GLASS CLOTH -- 8305-01-276-9043

Product Identification

Product ID:FIBER GLASS CLOTH
MSDS Date:06/28/1989
FSC:8305
NIIN:01-276-9043
MSDS Number: BWRFR

=== Responsible Party ===
Company Name:CLARK-SCHWEBEL FIBER GLASS CORP
Box: 2627  
City: ANDERSON  
State: SC  
ZIP: 29622  
Country: US  
Info Phone Num: 803-224-3506  
Emergency Phone Num: 800-424-9300 (CHEMTREC)  
CAGE: 1H193

--- Contractor Identification ---
Company Name: CLARK-SCHWEBEL FIBER GLASS CORP  
Box: City: ANDERSON  
State: SC  
ZIP: 29622  
Country: US  
Phone: 803-224-3506  
CAGE: 1H193

============== Composition/Information on Ingredients ===============

Ingred Name: GLASS OXIDE  
Fraction by Wt: >99%  
OSHA PEL: 15 MG/M3 (MFR)  
ACGIH TLV: 5 MG/M3 (MFR)

Ingred Name: METHACRYLATO CHROMIC CHLORIDE  
Fraction by Wt: <1%  
OSHA PEL: N/K  
ACGIH TLV: N/K

===================== Hazards Identification ======================

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.  
Routes of Entry: Inhalation: YES  
Skin: NO  
Ingestion: NO  
OSHA TLV: N/K  
ACGIH TLV: N/K  
IARC: NO  
OSHA: NO  
NTP: NO

Health Hazards Acute: IF IN EYES OR ON SKIN, MAY CAUSE MILD IRRITATION. IF INHALED, MAY CAUSE UPPER RESPIRATORY TRACT IRRITATION. CHRONIC: NONE MENTIONED.  
Explanation of Carcinogenicity: NOT RELEVANT  
Effects of Overexposure: SEE HEALTH HAZARDS.

Medical Cond Aggravated by Exposure: NONE.

============== First Aid Measures ===============
First Aid: INGEST: CALL MD IMMEDIATELY. EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES WHILE LIFTING UPPER & LOWER EYELIDS. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. SKIN: WASH THOROUGHLY WITH SOAP AND COOL WATER. INHAL: IF INHALED AND AFFECTED, REMOVE INDIVIDUAL TO FRESH AIR. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION.

==================== Fire Fighting Measures =====================
Flash Point: NONE
Extinguishing Media: USE APPROPRIATE EXTINGUISHING MEDIA FOR PRIMARY SOURCE OF FIRE. PRODUCT IS NOT COMBUSTIBLE.
Fire Fighting Procedures: USE NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT.
Unusual Fire/Explosion Hazard: NONE.

================ Accidental Release Measures ==================
Spill Release Procedures: NO SPECIAL PRECAUTIONS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

================= Handling and Storage =================
Handling and Storage Precautions: FIBER GLASS CLOTH IS DENSE AND EVEN SMALL ROLLS ARE HEAVY. USE LIFT DEVICES TO PREVENT INJURIES. DO NOT ALLOW CLOTH TO CRUSH LIMBS OR EXTREMITIES.
Other Precautions: NONE KNOWN.

============= Exposure Controls/Personal Protection =============
Respiratory Protection: IF AIRBORNE FIBERGLASS CONCENTRATIONS EXCEED PERMISSIBLE EXPOSURE LEVELS, NIOSH/MSHA APPROVED RESPIRATORY PROTECTION FOR NUISANCE DUST IN ACCORDANCE WITH OSHA 1910.134 SHOULD BE USED. NONE NORMALLY REQUIRED.
Ventilation: USE LOCAL EXHAUST VENTILATION IF NECESSARY.
MAINTAIN
    AIRBORNE LEVELS TO BELOW ESTABLISHED LIMITS.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES.
Other Protective Equipment: IN SOME CIRCUMSTANCES, IT MAY BE
    ADVISABLE
    TO WEAR LONG SLEEVED, LOOSE FITTING CLOTHING.
Work Hygienic Practices: USE RECOM SFTY EQUIP. WASH W/SOAP &
    WATER AFTER
    HNDLG. WASH WORK CLOTHES SEPARATELY FROM OTHER CLTHG.
WIPE OUT
    (SUPDAT)
Supplemental Safety and Health
HYGIENE PRACT: WASHING MACHINE.

=================== Physical/Chemical Properties ====================
Spec Gravity: 2.54 (H*2O=1)
Solubility in Water: INSOLUBLE
Appearance and Odor: WHITE TO LIGHT GREEN, ODORLESS CLOTH.
Percent Volatiles by Volume: NONE

================== Stability and Reactivity Data =====================
Stability Indicator/Materials to Avoid: YES
STRONG BASES AND ACIDS (OXIDIZING MINERAL, ESPECIALLY OXALIC
    AND
    HYDROFLUORIC ACID).
Stability Condition to Avoid: NONE.
Hazardous Decomposition Products: GLASS CLOTHG: NONE. SMALL
    AMOUNTS OF
    OXIDES OF CARBON AND NITROGEN MAY BE EVOLVED IF EXPOSED
    TO FIRE.

===================== Disposal Considerations ======================
Waste Disposal Methods: AN INERT, SOLID WASTE. DISPOSE OF IN A
    LANDFILL
    IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

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SCIENTIFIC POLYMER PRODUCTS, INC -- POLYSTYRENE, 400 -- 6810-00N047324
===============  Product Identification  ================

Product ID:POLYSTYRENE, 400
MSDS Date:03/01/1991
FSC:6810
NIIN:00N047324
MSDS Number: BTQVW
=== Responsible Party ===
Company Name:SCIENTIFIC POLYMER PRODUCTS, INC
Address:6265 DEAN PARKWAY
City:ONTARIO
State:NY
ZIP:14519
Country:US
Info Phone Num:716-265-0413
Emergency Phone Num:716-265-0413
CAGE:0MW60
=== Contractor Identification ===
Company Name:SCIENTIFIC POLYMER PRODUCTS, INC
Address:6265 DEAN PARKWAY
Box:City:ONTARIO
State:NY
ZIP:14519
Country:US
Phone:716-265-0413
CAGE:0MW60

============ Composition/Information on Ingredients =============

Ingred Name:SYTRENE POLYMER; (POLYSTYRENE)
CAS:9003-53-6
RTECS #:WL6475000
Fraction by Wt: 99.9%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:ADDITIVES
Fraction by Wt: <0.1%
OSHA PEL:N/K
ACGIH TLV:N/K

===================== Hazards Identification ======================

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:NO  Skin:NO  Ingestion:NO
Reports of Carcinogenicity:NTP:NO  IARC:NO  OSHA:NO
Health Hazards Acute and Chronic:NONE SPECIFIED BY MANUFACTURER.
Explanation of Carcinogenicity:NOT RELEVANT.
Effects of Overexposure:NONE SPECIFIED BY MANUFACTURER.
Medical Cond Aggravated by Exposure: NONE SPECIFIED BY MANUFACTURER.

======================= First Aid Measures ========================

First Aid: INGEST: CALL MD IMMEDIATELY. INHAL: REMOVE FROM EXPOSURE. IF BREATHING STOPS, BEGIN MOUTH TO MOUTH. EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES. SKIN: WASH AFFECTED AREA WITH SOAP AND WATER. REMOVE DIRTY CLOTHING. IN ALL CASES, IF IRRITATION DEVELOPS, SEEK MEDICAL ASSISTANCE.

===================== Fire Fighting Measures ======================

Flash Point Method: COC
Flash Point: 977F, 525C
Extinguishing Media: DRY CHEMICAL, CO*2, WATER.
Fire Fighting Procedures: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT.

Unusual Fire/Explosion Hazard: DECOMPOSITION MAY RESULT IN RELEASE OF CO*2 AND ORGANICS OF UNKNOWN CHEMICAL COMPOSITION. FLAMMABLE DUST WHEN FINELY DIVIDED & SUSPENDED IN AIR.

================== Accidental Release Measures ==================

Spill Release Procedures: SWEEP UP SPILL AND PLACE IN CONTAINERS FOR SALVAGE OR DISPOSAL.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

====================== Handling and Storage =======================

Handling and Storage Precautions: TREAT AS A COMBUSTIBLE SOLID. STORE AWAY FROM OXIDIZING MATLS IN A COOL, DRY PLACE WITH ADEQUATE VENTILATION.
Other Precautions: KEEP AWAY FROM HEAT AND OPEN FLAMES. KEEP
CONTAINERS
  TIGHTLY CLOSED. NOTE: THIS MATERIAL IS INTENDED FOR LABORATORY USE ONLY. IT IS NOT INTENDED FOR DRUG, HOUSEHOLD OR OTHER USES.

========== Exposure Controls/Personal Protection ============

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN.
Ventilation: LOCAL EXHAUST ADEQUATE.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: ANSI APPRVD CHEM WORKER GOGGLES.
Other Protective Equipment: ANSI APPRVD EMERGENCY EYE WASH & DELUGE SHOWER.
Work Hygienic Practices: GOOD HYGIENE PRACTICES SHOULD BE STRICTLY FOLLOWED.

Supplemental Safety and Health
NONE SPECIFIED BY MANUFACTURER.

========== Physical/Chemical Properties ===========

Melt/Freeze Pt: M.P/F.P Text: >212F, >100C
Spec Gravity: 1.05
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS, ODORLESS PELLET

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid: YES STRONG OXIDIZING AGENTS.
Hazardous Decomposition Products: CO AND ORGANICS OF UNKNOWN CHEMICAL COMPOSITION.

========== Disposal Considerations ===========

Waste Disposal Methods: IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

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of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.
Product ID: 05536 DOW GRAYBOARD EXTRUDED POLYSTYRENE FOAM INSULATION
MSDS Date: 06/13/1990
FSC: 5640
NIIN: 00F024892
MSDS Number: BNYRD

Company Name: DOW CHEMICAL CO
Address: 2030 DOW CENTER
City: MIDLAND
State: MI
ZIP: 48674
Country: US
Info Phone Num: (517) 636-4410
Emergency Phone Num: (517) 636-4410
CAGE: 0BG07

Company Name: DOW CHEMICAL CO THE
Address: 1801 DOW CTR
City: MIDLAND
State: MI
ZIP: 48674-1801
Country: US
Phone: 517-636-4400 / 800-258-2436
CAGE: 0BG07

Company Name: DOW CHEMICAL U.S.A.
City: MIDLAND
State: MI
ZIP: 48674
Country: US
Phone: 517-636-4400
CAGE: 71983

Ingred Name: ETHENE-1-OCTENE COPOLYMER; POLYETHYLENE
CAS: 26227-73-8
Fraction by Wt: 0-10%

Ingred Name: STYRENE POLYMER, POLYSTYRENE
CAS: 9003-53-6
RTECS #: WL6475000
Fraction by Wt: BALANCE
Ingred Name: DICHLORODIFLUOROMETHANE, FREON 12  
CAS: 75-71-8  
RTECS #: PA8200000  
Fraction by Wt: 0-7.5%  
Other REC Limits: 1000 PPM  
OSHA PEL: 4950 MG/CUM  
ACGIH TLV: 4950 MG/CUM  
EPA Rpt Qty: 5000 LBS  
DOT Rpt Qty: 5000 LBS  
Ozone Depleting Chemical: 1

Ingred Name: ETHANE, 1-CHLORO-1,1-DIFLUORO-, CHLORODIFLUOROETHANE (DOT), FREON 142, DIFLUOROROMONOCHLOROETHANE  
CAS: 75-68-3  
RTECS #: KH7650000  
Fraction by Wt: 0-10%  
Ozone Depleting Chemical: 2

Ingred Name: POLYETHYLENE, POLYETHYLENE RESIN (HOMOPOLYMER)  
CAS: 9002-88-4  
RTECS #: TQ3325000  
Fraction by Wt: 0-10%

Ingred Name: HEXABROMOCYCLODODECANE *92-2*  
CAS: 3194-55-6  
Fraction by Wt: 0-2%

Ingred Name: 1,2,3,4,5-PENTABROMO-6-CHLOROCYCLOHEXANE *92-2*  
CAS: 87-84-3  
Fraction by Wt: 0-2%

Ingred Name: ETHYL CHLORIDE, CHLOROETHANE  
CAS: 75-00-3  
RTECS #: KH7525000  
Fraction by Wt: 0-4.5%  
Other REC Limits: 2600 MG/CUM  
OSHA PEL: 1000 PPM  
ACGIH TLV: 1000 PPM  
EPA Rpt Qty: 100 LBS  
DOT Rpt Qty: 100 LBS

=============== Hazards Identification ===============
Routes of Entry: Inhalation: YES Skin: YES Ingestion: YES
Reports of Carcinogenicity: NTP: NO IARC: NO OSHA: NO
Health Hazards Acute and Chronic: EYES: IRRITATION OR CORNEAL INJURY. SKIN: MECHANICAL INJURY. INGESTION: LIVER & KIDNEY EFFECTS, INCREASE IN TISSUE LEVELS OF BROMINE, PHYSICAL INJURY, CHOKING.
INHALATION: SEVERE RESPIRATORY EFFECTS, UPPER RESPIRATORY TRACT IRRITATION, CNSDEPRESSION, ANESTHETIC EFFECTS, IRREGULAR HEARTBEATS & CARDIAC SENSITIZATION.
Explanation of Carcinogenicity: NONE
Effects of Overexposure: EYES: IRRITATION OR CORNEAL INJURY. SKIN: MECHANICAL INJURY. INGESTION: LIVER & KIDNEY EFFECTS, INCREASE IN TISSUE LEVELS OF BROMINE, PHYSICAL INJURY, CHOKING.
INHALATION: SEVERE RESPIRATORY EFFECTS, UPPER RESPIRATORY TRACT IRRITATION, CNSDEPRESSION, ANESTHETIC EFFECTS, IRREGULAR HEARTBEATS & CARDIAC SENSITIZATION.

======================= First Aid Measures
=======================

First Aid: EYES: IRRIGATE W/WATER FOR 5 MIN. INHALATION: REMOVE TO FRESH AIR. SKIN/INGESTION: OBTAIN MEDICAL ATTENTION IN ALL CASES.

==================== Fire Fighting Measures =====================

Flash Point Method: PMCC
Flash Point: 670F
Extinguishing Media: WATER FOG
Fire Fighting Procedures: WEAR POSITIVE-PRESSURE SCBA. APPLY LARGE VOLUME OF WATER DIRECTLY ON FLAME OR BURNING SURFACE. Unusual Fire/Explosion Hazard: EMITS DENSE, BLACK SMOKE WHEN BURNED. GRINDING OR CUTTING MAY LEAD TO A BUILDUP OF DUST SUSPENDED IN AIR WHICH CAN CAUSE A DUST EXPLOSION IF IGNITED.

================== Accidental Release Measures ===================

Page 78 of 149
Spill Release Procedures: PICK UP, OR IF DUST/SMALL PIECES, SWEEP UP & PLACE IN SUITABLE CONTAINER FOR DISPOSAL.

Handling and Storage

Handling and Storage Precautions: DON’T STORE OR USE IN CONFINED, VIRTUALLY AIRTIGHT SPACES TO PREVENT BUILDUP OF COMBUSTIBLE VAPORS.

Other Precautions: USE ONLY AS DIRECTED BY THE SPECIFIC INSTRUCTIONS FOR THIS PRODUCT. PROVIDE ADEQUATE VENTILATION, & APPROPRIATE DUST HANDLING SYSTEMS.

Exposure Controls/Personal Protection

Respiratory Protection: USE AN APPROVED AIR-PURIFYING/APPROVED DUST RESPIRATOR.

Ventilation: GENERAL/LOCAL EXHAUST

Eye Protection: GLASSES/CHEMICAL GOGGLES

Supplemental Safety and Health

GAS FIRED RECIRCULATING AIR FURNACES/HEATERS, GAS WATER HEATERS CAN BE SUBJECTED TO RUST/CORROSION PROBLEMS. THIS INSULATION CONTAINS A FLAME RETARDANT ADDITIVE TO INHIBIT ACCIDENTAL IGNITION FROM FIRE SOURCES. PRODUCT MAY CONTAIN EITHER 9002-88-4 OR 26221-73-8.

Physical/Chemical Properties

Spec Gravity: 0.027 TO 0.064
Solubility in Water: INSOLUBLE
Appearance and Odor: RIGID CELLULAR FOAM BOARD, NO ODOR.

Stability and Reactivity Data

Stability Indicator/Materials to Avoid: YES AROMATIC HYDROCARBONS, HIGHER (>C5) ALIPHATIC HYDROCARBONS, ESTERS, AMINES, HIGHER ALDEHYDES.
Stability Condition to Avoid: FIRE, HIGH TEMPS. TEMPERATURES OVER 572°F WILL RELEASE COMBUSTIBLE GASES.
Hazardous Decomposition Products: CO, CO₂, HYDROGEN
   BROMIDE/CHLORIDE/FLUORIDE & SMALL AMOUNTS OF AROMATIC HYDROCARBONS
   SUCH AS STYRENE & ETHYLBENZENE.
Conditions to Avoid Polymerization: FLAME OR OTHER IGNITION SOURCES

====================  Disposal Considerations  ====================

Waste Disposal Methods: BURY IN AN APPROVED LANDFILL, OR BURN IN AN ADEQUATE INCINERATOR W/EXCESS OXYGEN, IN ACCORDANCE W/LOCAL, STATE & FEDERAL REGULATIONS.

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KING ADHESIVES CORP -- 11-282 DUCT TAPE ADHESIVE -- 8040-00F038125

=============== Product Identification ===============

Product ID: 11-282 DUCT TAPE ADHESIVE
MSDS Date: 02/07/1992
FSC: 8040
NIIN: 00F038125
MSDS Number: BWKRB

==== Responsible Party ====
Company Name: KING ADHESIVES CORP
Address: 5231 NORTHRUP AVE
City: ST LOUIS
State: MO
ZIP: 63110-5000
Country: US
Info Phone Num: 314-772-9953/800-233-8171
Emergency Phone Num: 314-772-9953/800-233-8171
CAGE: KINGG

==== Contractor Identification ====
Company Name: KING ADHESIVES CORP
Address: 5231 NORTHRUP AVE
Box: City: ST LOUIS
State: MO
ZIP: 63110-5000
Country: US
Phone: 314-772-9953/800-233-8171
CAGE: KINGG

========== Composition/Information on Ingredients ==========

Ingred Name: NON HAZARDOUS INGREDIENTS

================= Hazards Identification =================

Routes of Entry: Inhalation: NO  Skin: NO  Ingestion: NO
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO
Health Hazards Acute and Chronic: EYES: IRRITATION, DAMAGE TO MUCOUS LININGS. SKIN: IRRITATION. INHALATION: NASAL & RESPIRATORY IRRITATION. INGESTION: GI IRRITATION.
Explanation of Carcinogenicity: NONE
Effects of Overexposure: REDNESS, TEARING, BLURRED VISION, IRRITATION.
First Aid Measures

First Aid: EYES: FLUSH W/ WATER FOR 15 MINS. INHALATION: REMOVE TO FRESH AIR. INGESTION: DON'T INDUCE VOMITING. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Fire Fighting Measures

Flash Point Method: TCC
Flash Point: >203F
Extinguishing Media: FOAM, CO2, DRY CHEMICAL, WATER FOG
Fire Fighting Procedures: WEAR SELF CONTAINED BREATHING APPARATUS W/ FULL FACE PIECE OPERATED IN A PRESSURE DEMAND/OTHER POSITIVE PRESSURE MODE. DRY FILM WILL BURN.

Accidental Release Measures

Spill Release Procedures: DIKE AREA TO PREVENT FROM SPreading. COLLECT MATERIAL IN SALVAGE CONTAINER. MATERIAL WILL FLOW.

Handling and Storage

Handling and Storage Precautions: DON'T STORE IN TEMP >125F/BELow FREEZING. WHEN HANDLING MATERIAL, ALWAYS FOLLOW PERSONAL PROTECTION INSTRUCTION & NEVER TRANSFER.

Exposure Controls/Personal Protection

Respiratory Protection: NONE REQUIRED
Ventilation: GENERAL MECHANICAL
Protective Gloves: IMPERVIOUS ARE RECOMMENDED
Eye Protection: SAFETY GLASSES
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

Supplemental Safety and Health
= Physical/Chemical Properties =

Boiling Pt:B.P. Text:212F
Vapor Density:>1
Spec Gravity:1.03
Evaporation Rate & Reference:SLOWER THAN ETHER
Solubility in Water:COMPLETE
Appearance and Odor:WHITE COLORED THIN VISCOSITY LIQUID W/BLAND ODOR
Percent Volatiles by Volume:45-53

= Stability and Reactivity Data =

Stability Indicator/Materials to Avoid:YES
SULFURIC ACID/ALKALI MATERIALS/SODIUM/METAL HYDRIDES.
Stability Condition to Avoid:FREEZING, TEMP <125F.
Hazardous Decomposition Products:CO2, CO, CARBON, ACETIC ACID/ACETALDEHYDE

= Disposal Considerations =

Waste Disposal Methods:DISPOSE OF IAW/FEDERAL, STATE & LOCAL REGULATIONS.

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SECTION 1: PRODUCT AND COMPANY IDENTIFICATION
PRODUCT NAME: SCOTCH BRAND #232 HIGH PERFORMANCE MASKING TAPE
MANUFACTURER: 3M
DIVISION: Industrial Tape And Specialties Division
ADDRESS: 3M Center
St. Paul, MN  55144-1000
EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)
Issue Date: 01/11/2005
Supercedes Date: 07/24/2003
Document Group: 07-0454-4
Product Use:
Intended Use: Used in medium temperature paint bake operations.
Limitations on Use: 250°F for up to one hour.

SECTION 2: INGREDIENTS
Ingredient C.A.S. No. % by Wt
SATURATED PAPER BACKING MIXTURE 35 - 50
RUBBER / RESIN ADHESIVE MIXTURE 5 - 20

SECTION 3: HAZARDS IDENTIFICATION
3.1 EMERGENCY OVERVIEW
Specific Physical Form: Roll of Tape
Odor, Color, Grade: Tan color paper with unpigmented adhesive
General Physical Form: Solid
Immediate health, physical, and environmental hazards: The environmental properties of this product present a low environmental hazard. This product, when used under reasonable conditions and in accordance with the 3M directions for use, should not present a health hazard. However, use or processing of the product in a manner not in accordance with the product's directions for use may affect the performance of the product and may present potential health and safety hazards.

3.2 POTENTIAL HEALTH EFFECTS
Eye Contact:
No health effects are expected.
Skin Contact:
No health effects are expected.
Inhalation:
No health effects are expected.
Ingestion:
No health effects are expected.

3.3 POTENTIAL ENVIRONMENTAL EFFECTS
This substance does not leach metals or other RCRA (Resource Conservation and Recovery Act) listed TCLP (Toxic Characteristic Leaching Procedure) hazardous substances at concentrations that would make the product a hazardous waste.

SECTION 4: FIRST AID MEASURES
4.1 FIRST AID PROCEDURES
The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.
Eye Contact: No need for first aid is anticipated.
Skin Contact: No need for first aid is anticipated.
Inhalation: No need for first aid is anticipated.
If Swallowed: No need for first aid is anticipated.

SECTION 5: FIRE FIGHTING MEASURES
5.1 FLAMMABLE PROPERTIES
Autoignition temperature 451 ºF
Flash Point No Data Available
Flammable Limits - LEL Not Applicable
Flammable Limits - UEL Not Applicable
5.2 EXTINGUISHING MEDIA Ordinary combustible material. Use fire extinguishers with class A extinguishing agents (e.g., water, foam). Use fire extinguishers with class B extinguishing agents (e.g., dry chemical, carbon dioxide).
5.3 PROTECTION OF FIRE FIGHTERS
Special Fire Fighting Procedures: See Hazardous Decomposition section for products of combustion. Nonflammable. Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).
Unusual Fire and Explosion Hazards: Not applicable. No unusual fire or explosion hazards are anticipated. Non-flammable: ordinary combustible material.
Note: See STABILITY AND REACTIVITY (SECTION 10) for hazardous combustion and thermal decomposition information.

SECTION 6: ACCIDENTAL RELEASE MEASURES
Accidental Release Measures: Collect as much of the spilled material as possible. Reclaim undamaged product.

SECTION 7: HANDLING AND STORAGE
7.1 HANDLING
Do not ingest. Do not breathe thermal decomposition products. Avoid skin contact with hot material. Avoid eye contact with vapors, mists, or spray. This product is considered to be an article which does not
release or otherwise result in exposure to a hazardous chemical under normal use conditions. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below Occupational Exposure Limits. If ventilation is not adequate, use respiratory protection equipment.

7.2 STORAGE
Store out of direct sunlight. Not applicable. Store under normal warehouse conditions.

SECTION 8: EXPOSURE CONTROLS/PERSOAL PROTECTION

8.1 ENGINEERING CONTROLS
Not applicable. Provide appropriate local exhaust for molten or extruded material. Provide appropriate local exhaust when product is heated. General ventilation adequate below 400 C. Local exhaust recommended above 400 C.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection
Avoid eye contact. Not applicable. Avoid eye contact with vapors, mists, or spray.

8.2.2 Skin Protection
Wear appropriate gloves, such as Nomex, when handling this material to prevent thermal burns. Not applicable. Avoid skin contact. Avoid prolonged or repeated skin contact. Avoid skin contact with hot material. Gloves are not required. Select and use gloves and/or protective clothing to prevent skin contact based on the results of an exposure assessment. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible materials.

8.2.3 Respiratory Protection
Under normal use conditions, airborne exposures are not expected to be significant enough to require respiratory protection. 8.2.4 Prevention of Swallowing
Not applicable. Do not ingest.

8.3 EXPOSURE GUIDELINES
None Established

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Specific Physical Form: Roll of Tape
Odor, Color, Grade: Tan color paper with unpigmented adhesive
General Physical Form: Solid
Autoignition temperature 451 °F
Flash Point No Data Available
Flammable Limits - LEL Not Applicable
Flammable Limits - UEL Not Applicable
Boiling point Not Applicable
Density 0.84 - 0.88 g/ml
Vapor Density Not Applicable
**Vapor Density** Negligible  
**Vapor Pressure** *Not Applicable*  
**Vapor Pressure** Negligible  
**Specific Gravity** Approximately 0.85 g/ml  
**pH** *Not Applicable*  
**Melting point** *Not Applicable*  
**Solubility In Water** *Not Applicable*  
**Solubility in Water** Negligible  
**Evaporation rate** *Not Applicable*  
**Hazardous Air Pollutants** *No Data Available*  
**Volatile Organic Compounds** <=0.2 %  
**Percent volatile** *Not Applicable*  
**VOC Less H2O & Exempt Solvents** <=0.2 %  
**Viscosity** *Not Applicable*

**SECTION 10: STABILITY AND REACTIVITY**

**Stability:** Stable.  
**Materials and Conditions to Avoid:** None known   
**Additional Information:** Excessive heat  
**Hazardous Polymerization:** Hazardous polymerization will not occur.  
**Hazardous Decomposition or By-Products**

**Substance Condition**
- Hydrocarbons Not Specified
- Carbon monoxide Not Specified
- Carbon dioxide Not Specified

**Hazardous Decomposition:** Under recommended usage conditions, hazardous decomposition products are not expected. Hazardous decomposition products may occur as a result of oxidation, heating, or reaction with another material.

**SECTION 11: TOXICOLOGICAL INFORMATION**

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

**SECTION 12: ECOLOGICAL INFORMATION**

**ECOTOXICOLOGICAL INFORMATION**

Not determined. Not applicable.

**CHEMICAL FATE INFORMATION**

Not determined. Not applicable.

**SECTION 13: DISPOSAL CONSIDERATIONS**

**Waste Disposal Method:** Reclaim if feasible. If product can’t be reclaimed, dispose of waste product in a sanitary landfill. Alternatively, incinerate the waste product in an industrial, commercial, or municipal incinerator. Dispose of waste product in a sanitary landfill. As a disposal alternative, incinerate in an industrial or commercial facility.

**EPA Hazardous Waste Number (RCRA):** Not regulated
Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14: TRANSPORT INFORMATION
Please contact the emergency numbers listed on the first page of the MSDS for Transportation Information for this material.

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS
Contact 3M for more information.

311/312 Hazard Categories:
- Fire Hazard - No
- Pressure Hazard - No
- Reactivity Hazard - No
- Immediate Hazard - No
- Delayed Hazard – No

STATE REGULATIONS
Contact 3M for more information.

CHEMICAL INVENTORIES
The components of this product are in compliance with the chemical notification requirements of TSCA.
All applicable chemical ingredients in this material are listed on the European Inventory of Existing Chemical Substances (EINECS), or are exempt polymers whose monomers are listed on EINECS.
This product is an article as defined by TSCA regulations, and is exempt from TSCA Inventory listing requirements.
Contact 3M for more information.

INTERNATIONAL REGULATIONS
Contact 3M for more information.

WHMIS: Hazardous

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification
- Health: 0
- Flammability: 1
- Reactivity: 0
- Special Hazards: None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

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SUPER GLUE CORP -- SUPER GLUE -- 8040-00N056030
================================ Product Identification ==================

Product ID: SUPER GLUE
MSDS Date: 08/18/1993
FSC: 8040
NIIN: 00N056030
MSDS Number: BWBXW
=== Responsible Party ===
Company Name: SUPER GLUE CORP
Address: 184-08 JAMACA AVE
City: HOLLIS
State: NY
ZIP: 11423
Country: US
Info Phone Num: 718-454-4747
Emergency Phone Num: 800-424-9300 (CHEMTREC)
CAGE: 0ACS9
=== Contractor Identification ===
Company Name: SUPER GLUE CORP
Address: 184-08 JAMAICA AVE
Box: City: HOLLIS
State: NY
ZIP: 11423
Country: US
Phone: 800-221-4478
CAGE: 0ACS9

========== Composition/Information on Ingredients ===========

Ingred Name: 2-PROPENOIC ACID, 2-CYANO-, ETHYL ESTER; (ETHYL CYANOACRYLATE)
CAS: 7085-85-0
RTECS #: UD3330000
Fraction by Wt: 60-100%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name: HYDROQUINONE (SARA III)
CAS: 123-31-9
RTECS #: MX3500000
Fraction by Wt: 0-1%
OSHA PEL: 2 MG/M3
ACGIH TLV: 2 MG/M3
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Ingred Name: POLYMETHYL METHACRYLATE
CAS: 9011-14-7
RTECS #: TR0400000
Fraction by Wt: 10-30%
OSHA PEL: N/K
ACGIH TLV: N/K

Ingred Name: SUPDAT: (DO NOT PULL) LIPS APART. IT IS ALMOST IMPOSSIBLE TO SWALLOW CYANOACRYLATE AS ADHESIVE SOLIDIFIES UPON (ING 5)
RTECS #: 9999999ZZ

Ingred Name: ING 4: CONT W/SALIVA & MAY ADHERE TO INSIDE OF MOUTH. SALIVA WILL LIFT ADHESIVE IN 1-2 DAYS, AVOID SWALLOWING (ING 6)
RTECS #: 9999999ZZ

Ingred Name: ING 5: ADHESIVE AFTER DETACHMENT.
RTECS #: 9999999ZZ

===================== Hazards Identification =====================

LD50 LC50 Mixture: LD50:(ORAL) 12.2 CC/KG
Routes of Entry: Inhalation:YES Skin:NO Ingestion:YES
Reports of Carcinogenicity: NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic: ACUTE: IRRITATES EYES, MUCOUS MEMBRANES. CHRONIC: NO RESIDUAL AFFECTS OF ACUTE PROPERTIES.
Explanation of Carcinogenicity: NOT RELEVANT.
Effects of Overexposure: SEE HEALTH HAZARDS.
Medical Cond Aggravated by Exposure: PRE-EXISTING SKIN, EYE AND RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE.
First Aid Measures

First Aid: EYE: TEARING FROM EYE IRRIT. REMOVE TO FRESH AIR. FLUSH AREAS OF CONT W/WATER FOR @ LEAST 15 MINS. ADHESIVE WILL DISASSOCIATE FROM EYE/EYELIDS OVER TIME, USUALLY W/IN SEVERAL HRS. TEMPORARY WEEPING OF EYES/DIAG HIONAL VISION MAY BE EXPERIENCED UNTIL CLEARANCE IS ACHIEVED. SKIN: IMMERSE BONDED AREAS IN WARM, SOAPY WATER. PEEL/ROLL SKIN APART. REMOVE SECURED ADHESIVE W/SEVERAL APPLIC OF WARM, SOAPY (SUPDAT)

Fire Fighting Measures

Flash Point Method: TCC
Flash Point: 176°F, 80°C
Extinguishing Media: FLUSH WITH LARGE AMOUNTS OF WATER OR DRY CHEMICAL EXTINGUISHER.
Fire Fighting Procedures: NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP. FUMES MAY BE IRRITATING IF NOT BURNING & REQ AIR SUPPLY W/GOGG WHILE APPLYING LG AMTS OF WATER/DRY (SUPDAT) Unusual Fire/Explosion Hazard: NONE. COMBUSTIBLE REQUIRING THE ABOVE PROCEDURES.

Accidental Release Measures

Spill Release Procedures: POLYMERIZE WITH WATER. SOLID MATERIAL MAY BE SCRAPED FROM SURFACE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Handling and Storage

Handling and Storage Precautions: AVOID MOISTURE, DIRECT UV=SUNLIGHT AND
DO NOT STORE ABOVE 25C. KEEP CNTNRS CLSD TIGHTLY WHEN NOT IN USE.
AVOID BRTHG VAP, CONT WITH EYES/SKIN.
Other Precautions:DO NOT SOTRE AT -5C WHICH FREEZES PRODUCT TO USELESS STATE. PRODUCT NOT DAMAGED BY FREEZING.

============ Exposure Controls/Personal Protection =============

Respiratory Protection:NORMALLY NOT NECESSARY. A NIOSH/MSHA APPROVED ORGANIC VAPOR CANISTER MAY BE USED.
Ventilation:LOCAL EXHAUST:TO PREVENT EYE IRRITATION. MECHANICAL (GENERAL):LARGE AMOUNT:USED TO 2PPM.
Protective Gloves:VINYL (POLYETHYLENE)NON-STICKING GLOVES.
Eye Protection:SAFETY GLASSES & SIDE SHIELD.
Other Protective Equipment:RUBBER APRON TO PROTECT CLOTHING.

Supplemental Safety and Health SOL IN H*20:INSOLUBLE, MATL REACTS TO HARDENED MASS FOR NON-HAZ WASTE.
FIRE FIGHT PROC:CHEM EXTING. FIRST AID PROC:WATER. INHAL:IRRIT OF MUC MEMB/COUGHING. REMOVE TO FRESH AIR. INGEST:LIPS MAY BECOME STUCK TOGETHER:APPLY COPIOUS AMTS OF WARM WATER & ENCOURAGE SWETTING/PRESS FROM SALIVA INSIDE MOUTH. PEEL/ROLL (ING 4)

============== Physical/Chemical Properties ===============

Boiling Pt:B.P. Text:149F,65C
Vapor Pres:1 @ 20C
Spec Gravity:1.05 (H*20=1)
Evaporation Rate & Reference:NOT KNOWN
Solubility in Water:SUPP DATA
Appearance and Odor:TRANSPARENT WATER-WHITE TO STRAW COLORED LIQUID WITH STIMULATIVE ODOR

============== Stability and Reactivity Data ===============

Stability Indicator/Materials to Avoid:YES POLYMERIZED BY WATER, ALCOHOL, AMINES, ALKALINE MATERIALS
AND DIRECT

UV.

Stability Condition to Avoid: EXCESSIVE HEAT ABOVE 176°F, MOISTURE AND ALKALINES. STABLE UP TO 122°F. STORE IN COOL DRY PLACE.

Hazardous Decomposition Products: COMBUSTIBLE BY-PRODUCTS OF CARBON MONOXIDE/DIOXIDE.

====================  Disposal Considerations  ====================

Waste Disposal Methods: INCINERATE SOLID COMBUSTIBLE WASTE OR DUMP AS CHEMICAL WASTE ACCORDING TO LOCAL, STATE AND FEDERAL REGULATIONS.

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EMS CATALOG NO: 10000
EMS PRODUCT: Acetone
DATE: 4/22/96
PAGE NUMBER: One of 7

MATERIAL SAFETY DATA SHEET

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321 MORRIS ROAD
P.O. BOX 251
FORT WASHINGTON, PA 19034 24 HOUR EMERGENCY PHONE NUMBER
(215) 646-1566 CHEMTREC: (800) 424-9300

FOR PRODUCT AND SALES INFORMATION
CONTACT ELECTRON MICROSCOPY SCIENCES OFFICE ABOVE.
PRODUCT IDENTIFICATION

PRODUCT NAME: Acetone
CAS NO.: 67-64-1
COMMON NAMES/SYNONYMS: 2-Propanone Dimethyl Ketal, Dimethyl Ketone
FORMULA: C₃H₆O
MOLECULAR WEIGHT: 58.08

NFPA RATING (MANUFACTURER):  
HAZARD RATING SCALE:
HEALTH: 1  
FIRE: 3  
REACTIVITY: O  
SPECIAL: None 
0 = NONE
1 = MINIMAL
2 = MODERATE
3 = SERIOUS
4 = SEVERE

HAZARDOUS INGREDIENTS
EXPOSURE LIMITS, PPM
OSHA ACGIH OTHER

COMPONENT   CAS NO.   %    PEL   TLV     LIMIT       HAZARD
Acetone    67-64-1 >99   750   750     1,000       Flammable/Irritant
           (ACGIH STEL)

PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT: 133F
MELTING POINT: 142F
SPECIFIC GRAVITY (WATER=1): 0.79
VAPOR PRESSURE, mm Hg: 184
pH: No data found
VAPOR DENSITY (AIR=1): 2.0
WATER SOLUBILITY: 100%
EVAPORATION RATE (BUTYL ACETATE=1): 5.6
% VOLATILE (BY VOLUME): 100
APPEARANCE AND ODOR: Clear, colorless liquid; sweet odor.

FIRST AID MEASURES

INHALATION: Remove to fresh air. Give artificial respiration if not breathing. Get immediate medical attention.

EYE CONTACT: Immediately flush eyes with lots of running water for 15 minutes, lifting the upper and lower eyelids occasionally. Get
immediate attention.

SKIN CONTACT: Immediately wash skin with lots of soap and water. Remove contaminated clothing and shoes; wash before reuse. Get medical attention if irritation persists after washing.

INGESTION: Do not induce vomiting. If conscious, give lots of water. Get immediate medical attention. Do not give anything by mouth to an unconscious or convulsing person.

NOTES TO PHYSICIAN: The danger of aspiration must be weighed against toxicity when considering emptying the stomach. Stomach contents should be emptied quickly in a manner which avoids the vomitus from entering the lungs.

HEALTH HAZARD INFORMATION

PRIMARY ROUTES OF EXPOSURE: Inhalation, skin or eye contact.

SIGNS AND SYMPTOMS OF EXPOSURE:

INHALATION: Prolonged or repeated exposure or breathing very high concentration may cause headaches, nausea, vomiting, dizziness, other central nervous system effects, convulsions, and in extreme cases, unconsciousness and death.

EYE CONTACT: Vapors will irritate the eyes. Liquid and mists will irritate and may burn the eyes.

SKIN CONTACT: Brief contact may dry the skin. Prolonged or repeated contact may irritate the skin causing dermatitis.

INGESTION: Swallowing large quantities causes headaches, nausea, vomiting, and perhaps unconsciousness. Can also cause liver and kidney injury.

CHRONIC EFFECTS OF EXPOSURE: No specific information available.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:

Preexisting eye or skin disorders may be aggravated by acetone exposure. Also, use of alcoholic beverages enhances toxic effects.
TOXICITY DATA

ORAL: Rat LD50 = 9750 MG/KG  
DERMAL: Rabbit LD50 = 20 G/KG  
INHALATION: Rat LC50 = 16,000 PPM/4 HR

CARCINOGENICITY: This material is not considered to be a carcinogen by the National Toxicology Program, the International Agency for Research on Cancer, or The Occupational Safety and Health Administration.

OTHER DATA: Development of cataracts has been reported in laboratory animals after prolonged repeated skin exposure.

ECOLOGICAL INFORMATION SECTION
No data found

PERSONAL PROTECTION

VENTILATION: Local mechanical exhaust ventilation capable of maintaining emissions at the point of use below the PEL.

RESPIRATORY PROTECTION: If use conditions generate vapors or mists, wear a NIOSH- approved respirator appropriate for those emission levels.

Appropriate respirators may be a full facepiece or half mask air-purifying cartridge respirator equipped for organic vapors/mists, a self-contained breathing apparatus in the pressure demand mode, or a supplied-air respirator.

EYE PROTECTION: Chemical goggles unless a full facepiece respirator is also worn. It is generally recognized that contact lenses should not be worn when working with chemicals because contact lenses may contribute to the severity of an eye injury.

PROTECTIVE CLOTHING: Long-sleeved shirt, trousers, safety shoes, rubber gloves, and rubber apron.

OTHER PROTECTIVE MEASURES: An eyewash and safety shower should be nearby and ready for use.
FIRE AND EXPLOSION INFORMATION

FLASH POINT: -15oF METHOD USED: TCC
FLAMMABLE LIMITS IN AIR: LOWER: 2% UPPER: 13%
AUTOIGNITION TEMPERATURE: No data found
EXTINGUISHING MEDIA: Use water spray, dry chemical, CO2 or alcohol foam.

SPECIAL FIREFIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus and full protective clothing. Use water spray to cool nearby containers and structures exposed to fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Acetone is extremely flammable. Extinguish all nearby sources of ignition. Avoid accumulation of water or acetone vapors because aqueous solutions containing more than 2.5% acetone vapors are flammable. Vapors formed from this product are heavier than air and may travel along the surface to a distant sources of ignition and flashback. Explosive vapor-air mixtures may be formed above the flash point or between the lower and upper flammable limits.

HAZARDOUS REACTIVITY

STABILITY: Stable
POLYMERIZATION: Will not occur
CONDITIONS TO AVOID: Heat, Sparks, and Open Flames.
MATERIALS TO AVOID: Oxidizers, acids, alkalis, chlorinated compounds.

HAZARDOUS DECOMPOSITION PRODUCTS: May liberate carbon monoxide, carbon dioxide, and unidentified organic compounds in black smoke.

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills or leaks: wear protective equipment including rubber boots, rubber gloves, rubber apron, and a self-contained breathing apparatus in the pressure demand mode or a supplied-air respirator. If the spill or leak is small, a full facepiece air-purifying cartridge respirator equipped for organic vapors may be satisfactory. In any event, always wear eye protection. Extinguish all ignition sources and ensure that all handling equipment is electrically grounded. For small spills or drips, mop or wipe up and dispose of in DOT-approved waste containers. For large spills, contain by diking with soil or
other non-combustible absorbent materials and then pump into DOT-approved waste containers; or absorb with non-combustible sorbent material, place residue in DOT-approved waste containers. Keep out of sewers, storm drains, surface waters, and soil.

Comply with all applicable governmental regulations on spill reporting, and handling and disposal of waste.

DISPOSAL METHODS: Dispose of contaminated product and materials used in cleaning up spills or leaks in a manner approved for this material. Consult with appropriate Federal, State and local regulatory agencies.

NOTE: Empty containers can have residues, gases and mists and are subject to proper waste disposal, as above.

SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTIONS: Keep away from heat, sparks, and flames. Store in a cool, dry, well-ventilated place away from incompatible materials. Vent container frequently, and more often in warm weather, to relieve pressure. Electrically ground all equipment when handling this product and use only non-sparking tools. Keep container tightly closed when not in use.

Do not use pressure to empty container. Wash thoroughly after handling. Do not get in eyes, on skin, or on clothing.

REPAIR AND MAINTENANCE PRECAUTIONS: Do not cut, grind, weld, or drill on or near this container.

OTHER PRECAUTIONS: Containers, even those that have been emptied, will retain product residue and vapors. Always obey hazard warnings and handle empty containers as if they were full.

OTHER REGULATORY INFORMATION

SECTION 313 - This product is a toxic chemical subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
PROPOSITION 65 (WITH CHEMICALS LISTED) - This product contains the following chemical(s) considered by the state of California's safe drinking water and Toxic Enforcement Act of 1986 (Proposition 65) as causing cancer or reproductive toxicity and for which warnings are required:

<table>
<thead>
<tr>
<th>CHEMICALS</th>
<th>CAS NO.</th>
<th>% WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>30 PPM</td>
</tr>
</tbody>
</table>

MASSACHUSETTS - Under the Massachusetts right-to-know law, hazardous substance and extraordinarily hazardous substances components present in this product which requires reporting are:

<table>
<thead>
<tr>
<th>HAZARDOUS SUBSTANCE</th>
<th>CAS NO.</th>
<th>CONC.( &gt;1%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>67-64-1</td>
<td>100</td>
</tr>
</tbody>
</table>

PENNSYLVANIA - Under the Pennsylvania right-to-know law, hazardous substances and special hazardous substances components present in this product which require reporting are:

<table>
<thead>
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<th>CAS NO.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>67-64-1</td>
<td>100</td>
</tr>
</tbody>
</table>

CALIFORNIA SCAQMD: Rule 443.1 VOC’S
VOC: 790 G/L  Vapor Pressure: 184 MMHG AT 68oF.

TSCA: THE INGREDIENTS OF THIS PRODUCT ARE ON THE TSCA INVENTORY.
MATERIAL SAFETY DATA SHEET

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to obtained from the use thereof.

Electron Microscopy Sciences assumes no responsibility for personal injury or property damage to vendees, users or third parties caused by the material. Such vendees or users assume all risks associated with the use of the material.

ELECTRON MICROSCOPY SCIENCES
321 MORRIS ROAD
PRODUCT IDENTIFICATION

PRODUCT NAME: EM Glass
CHEMICAL NAME: Merckoglas(R) Liquid Cover Glass
CHEMICAL FAMILY: Organic substances in toluene
FORMULA: Organic substances in toluene
MOLECULAR WEIGHT: N/A

COMPONENT CAS # APPR %
Toluene 108-88-3 N/A

Also contains organic substances not disclosed by the manufacturer.

HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:
Flammable liquid and vapor.  
Harmful or fatal if swallowed.  
Vapor harmful.  
May be irritating to skin, eyes and mucous membranes.  
May cause damage to central nervous system, liver, kidneys and lungs.

APPEARANCE: Colorless, viscous liquid.

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:

Quantitative data on the toxicity of this product is not available.  
Expected properties on the grounds of the components:  
Harmful or fatal if swallowed. Vapor harmful if inhaled.

Symptoms: Headache, dizziness, hallucinations, distorted perceptions, changes in motor activity, nausea, diarrhea, respiratory irritation, central nervous system depression, unconsciousness, liver, kidney and lung damage. Contact can cause severe eye irritation. May cause skin irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Data not available.

ROUTES OF ENTRY: Inhalation, ingestion.

CARCINOGENICITY: The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

FIRST AID MEASURES

EMERGENCY FIRST AID:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

SKIN: Wash thoroughly with soap and water.

EYES: Immediately flush thoroughly with water for at least 15 minutes.  
INHALATION: Remove to fresh air; give artificial respiration if breathing has stopped.
INGESTION: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

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FIRE FIGHTING MEASURES

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FLASH POINT (F): 47°F
FLAMMABLE LIMITS LEL (%): N/A
FLAMMABLE LIMITS UEL (%): N/A

EXTINGUISHING MEDIA: Dry chemical, CO2, or "alcohol" foam.

FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus and protective clothing.

FIRE & EXPLOSION HAZARDS: Dangerous fire and explosion hazard. Vapor can travel distances to ignition source and flash back.

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ACCIDENTAL RELEASE MEASURES

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SPILL RESPONSE:

Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure/Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

The following Electron Microscopy Sciences clean up kit is recommended for this product:

SX0863 Solvent Spill Treatment Kit
HANDLING AND STORAGE

Keep container closed. Store in a cool, dry area away from ignition sources and oxidizers. Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves should be worn to prevent skin contact (Viton or equivalent).

Safety glasses with side shields should be worn at all times.

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

WORK/HYGIENIC PRACTICES:
Wash thoroughly after handling. Do not take internally. 
Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES:

TWA  STEL  CL
COMPONENT  PPM  MG/M3  PPM  MG/M3  PPM  MG/M3  SKIN
Toluene  100  375  150  560

ACGIH - TLV:
TWA  STEL  CL
COMPONENT  PPM  MG/M3  PPM  MG/M3  PPM  MG/M3  SKIN
Toluene  50  188  X

PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT (C 760 mmHg): N/A
MELTING POINT (C): N/A
SPECIFIC GRAVITY (H2O = 1): .91
VAPOR PRESSURE (mm Hg) N/A
PERCENT VOLATILE BY VOL (%): N/A
VAPOR DENSITY (AIR =1): N/A
EVAPORATION RATE (BuAc = 1): N/a
SOLUBILITY IN WATER (%): Soluble
APPEARANCE: Colorless, viscous liquid.

STABILITY AND REACTIVITY

STABILITY: Stable.
HAZARDOUS POLYMERIZATION: Does not occur.
HAZARDOUS DECOMPOSITION: CO2, hydrocarbons.
CONDITIONS TO AVOID: Heat; contact with ignition sources.
MATERIALS TO AVOID: Oxidizers.
TOXICOLOGICAL INFORMATION

TOXICITY DATA: None established.

TOXICOLOGICAL FINDINGS: None-Cited in Registry of Toxic Effects of Substances (RTECS).

DISPOSAL CONSIDERATIONS

EPA WASTE NUMBERS: D001 U220
TREATMENT:
Incineration, fuels blending or recycle. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. Always contact a permitted waste disposer (TSD) to assure compliance with all current local, State and Federal regulations.

TRANSPORT INFORMATION

DOT SHIPPING NAME: Flammable liquid, n.o.s. (contains Toluene)
DOT NUMBER: UN1993

REGULATORY/OTHER INFORMATION

TSCA STATEMENT: This product is a "Mixture". CAS number(s) of component(s) NOT listed on TSCA Inventory.

For Research and Development Use only; Not for Manufacturing or Commercial purposes.
COMPONENT:  SARA EHS (302) SARA EHS TPQ (lbs) CERCLA RQ (lbs)

Toluene  1000

OSHA Floor List SARA 313 DeMinimis for SARA 313
%  
Toluene  Y  Y  1.0

NFPA Hazard Ratings: Health  - 1
Flammability - 3
Reactivity - 0

UNION OIL CO OF CALIFORNIA, CORP. DIV-EASTERN -- MINERAL SPIRITS 75 -- 8010-01-127-6897

Product Identification

Product ID:MINERAL SPIRITS 75
MSDS Date:01/01/1985
FSC:8010
NIIN:01-127-6897
MSDS Number: BGNCM

Responsible Party

Company Name:UNION OIL CO OF CALIFORNIA, CORP. DIV-EASTERN
Address:1650 EAST GOLF ROAD
City:SCHAUMBURG
State:IL
ZIP:60195
Country:US
Info Phone Num:708-619-2644
Emergency Phone Num:708-619-2644
CAGE:77416

=== Contractor Identification ===
Company Name:UNION OIL CO OF CALIFORNIA, CORP. DIV-EASTERN
Address:1650 EAST GOLF ROAD
Box:City:SCHAUMBURG
State:IL
ZIP:60195
Country:US
Phone:708-619-2644
CAGE:77416

=============  Composition/Information on Ingredients  =============
Ingred Name:NAPHTHA (PETROLEUM SPIRITS OR BENZIN)
CAS:8030-30-6
RTECS #:SE7555000
Fraction by Wt: 100%
OSHA PEL:100 PPM

=============  Hazards Identification  =============
Effects of Overexposure:EYES:SEVERE IRRIT. SKIN: DRYNESS.
INH:HDCH,DIZZ,NAUSEA.

=============  First Aid Measures  =============
First Aid:EYES: FLUSH W/WATER 15 MINS,CALL MD. SKIN:WASH W/MILD SOAP &
WATER,APPLY SKIN CREAM. INH:MOVE TO FRESH AIR & CALL MD.
APPLY
ARTIFICIAL RESP IF NEC.

=============  Fire Fighting Measures  =============
Flash Point:108F.42C PCC
Lower Limits:1.0
Upper Limits:6.0
Extinguishing Media:WATER SPRAY, CO2,FOAM,DRY CHEMICAL
Fire Fighting Procedures:WEAR SCBA. USE WATER SPRAY TO COOL
FIRE-EXPOSED CONTAINERS.
Unusual Fire/Explosion Hazard: A DANGEROUS FIRE HAZARD IF HEATED OR SPRAYED IN AIR.

Accidental Release Measures

Spill Release Procedures: FLUSH WITH WATER INTO RETAINING AREA OR CONTAINER. AVOID EXPOSURE TO SPARKS, FIRE, OR HOT METAL SURFACES. VENTILATE AREA.

Handling and Storage

Handling and Storage Precautions: KEEP AWAY FROM HEAT, SPARKS & OPEN FLAME. USE WITH ADEQUATE VENTILATION. AVOID PROLONGED OR REPEATED CONTACT W/SKIN. KEEP CNTNRS CLSD WHEN NOT IN USE.

Exposure Controls/Personal Protection

Respiratory Protection: SCBA FOR CONCENTRATIONS ABOVE TLV LIMITS. Ventilation: LOCAL EXHAUST
Protective Gloves: YES
Eye Protection: YES
Other Protective Equipment: EYE BATH AND SAFETY SHOWER.
Supplemental Safety and Health
CONFORMS TO TT-T-291E, TYPE II, GRADE A. BP: 156-198C. EVAP RATE: <0.1, N-BUAC PER GE MSDS #1257. CONTAINER SIZE: 1 QT. CAN.

Physical/Chemical Properties

HCC: F4
Boiling Pt: B.P. Text: 313F-388F
Vapor Pres: 2.0
Vapor Density: 4.9
Spec Gravity: 0.781
Evaporation Rate & Reference: SEE SUPP DATA
Solubility in Water: NEGLIGIBLE
Appearance and Odor: CLEAR LIQUID, CHARACTERISTIC ODOR.
Percent Volatiles by Volume: 100

Stability and Reactivity Data

Stability Indicator/Materials to Avoid: YES
STRONG OXIDIZING AGENTS
Stability Condition to Avoid: HEAT, SPARKS, OPEN FLAMES & FIRE.
Hazardous Decomposition Products: THERMAL DECOMP MAY YIELD CO.

==================== Disposal Considerations ====================
Waste Disposal Methods: INCINERATE UNDER SAFE CONDITIONS OR DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, OR FEDERAL REGULATIONS.

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HENRY SCHEIN INC -- ALCOHOL- DENATURED -- 6810-00F012186
==================== Product Identification =====================
Product ID: ALCOHOL-DENATURED
MSDS Date: 01/01/1987
FSC: 6810
NIIN: 00F012186
MSDS Number: BJBWG
=== Responsible Party ===
Company Name: HENRY SCHEIN INC
Address: 5 HARBOR PARK DR
City: PORT WASHINGTON
State: NY
ZIP: 11050
Info Phone Num: (516) 621-4300
Emergency Phone Num: (516) 621-4300
CAGE: 64682

=== Contractor Identification ===
Company Name: HENRY SCHEIN INC
Address: 5 HARBOR PARK DR
Box: City: PORT WASHINGTON
State: NY
ZIP: 11050
Phone: (516) 621-4300
CAGE: 64682

=============== Composition/Information on Ingredients ================
Ingred Name: METHYL ALCOHOL (METHANOL) (SARA III)
CAS: 67-56-1
RTECS #: PC1400000
Other REC Limits: 200 PPM
OSHA PEL: S, 200 PPM/250 STEL
ACGIH TLV: S, 200 PPM/250 STEL; 93
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS

===================== Hazards Identification ======================
Routes of Entry: Inhalation: YES  Skin: NO  Ingestion: NO
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO
Health Hazards Acute and Chronic: INHALATION: MAY CAUSE SYSTEMIC POISONING.
Explanation of Carcinogenicity: NONE
Effects of Overexposure: INHALATION: MAY CAUSE SYSTEMIC POISONING.

====================== First Aid Measures ========================

First Aid: EYES: FLUSH W/ PLENTY OF WATER. CONTACT PHYSICIAN. SKIN: WASH
COMMUNICATED AREA W/ SOAP & WATER. INGESTION: INDUCE VOMITING. GIVE
2 GLASSES WATER & STICK FINGER DOWN THROAT OR DILUTE POINT W/WATER.
INHALATION: REMOVE FROM CONTAMINATED AREA IMMEDIATELY.
== Fire Fighting Measures ==

- **Flash Point Method**: TOC
- **Flash Point**: 60°F
- **Lower Limits**: 5.5%
- **Upper Limits**: 36.5
- **Extinguishing Media**: Alcohol or polymer foam, CO2 or dry chemical
- **Fire Fighting Procedures**: Addition of water to burning fuel will reduce the intensity of flame.
- **Unusual Fire/Explosion Hazard**: None

== Accidental Release Measures ==

- **Spill Release Procedures**: Eliminate ignition source. Contain spill for salvage or disposal. Use of any dilution water should be closely controlled to minimize spill volume. Avoid run-off into storm sewers & ditches which lead to natural waterways. Advise authorities of spill.

== Handling and Storage ==

- Handling and Storage Precautions: Don’t leave container open. Use w/adequate ventilation. Avoid prolonged/repeated contact w/skin.

== Exposure Controls/Personal Protection ==

- **Respiratory Protection**: Self-contained breathing apparatus.
- **Ventilation**: Mechanical: acceptable. Local exhaust: preferable
- **Protective Gloves**: Neoprene, rubber
- **Eye Protection**: Chemical safety goggles
- **Other Protective Equipment**: Impermeable apron, boots, eye bath & safety shower.

== Physical/Chemical Properties ==

- **Boiling Pt**: B.P. Text: 64.6°F
Vapor Pres: 96.0
Vapor Density: 1.11
Spec Gravity: 0.7925
Evaporation Rate & Reference: (BU AC = 1): 1
Solubility in Water: COMPLETE
Appearance and Odor: WATER-WHITE LIQUID; CHARACTERISTIC ODOR.
Percent Volatiles by Volume: 100%

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid: YES
Stability Condition to Avoid: HEAT, SPARKS & FIRE

================= Disposal Considerations =================

Waste Disposal Methods: CHEMICAL INCINERATOR; BIOLOGICAL TREATMENT; LANDFILL.

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GOEX INC -- BLACK POWDER -- 1376-00N037788

Product ID: BLACK POWDER
MSDS Date: 09/01/1988
FSC: 1376
NIIN: 00N037788
MSDS Number: BQWTX

=== Responsible Party ===
Company Name: GOEX INC
Address: 1002 SPRINGBROOK AVE
City: MOOSIC
State: PA
ZIP: 18507
Country: US
Info Phone Num: 717-457-6724
Emergency Phone Num: 717-457-6724; 800-424-9300 (CHEMTREC)
CAGE: 51580

--- Contractor Identification ---
Company Name: GOEX INC
Address: 1002 SPRINGBROOK AVE
Box: City: MOOSIC
State: PA
ZIP: 18507
Country: US
Phone: 717-457-6724
CAGE: 51580

============= Composition/Information on Ingredients =============

Ingred Name: POTASSIUM NITRATE
CAS: 7757-79-1
RTECS #: TT3700000
Fraction by Wt: 70-76%

Ingred Name: CHARCOAL
CAS: 16291-96-6
RTECS #: FL7243500
Fraction by Wt: 8-18%

Ingred Name: SULFUR; (SULPHUR)
CAS: 7704-34-9
RTECS #: WS4250000
Fraction by Wt: 9-20%

===================== Hazards Identification =====================

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation: YES  Skin: NO  Ingestion: NO
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO
Explanation of Carcinogenicity: NOT RELEVANT

====================== First Aid Measures =======================
First Aid: INGEST: CALL MD IMMEDIATELY. INHAL: REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) . EYES: IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD. SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD.

Extinguishing Media: WATER.
Fire Fighting Procedures: DO NOT FIGHT FIRES. EVACUATE AREA. Unusual Fire/Explosion Hazard: DO NOT FIGHT FIRES. BLACK POWDER MAY DEFLAGRATE OR EXPLODE IN A FIRE WHILE CONFINED. EVACUATE AREA.

Accidental Release Measures

Spill Release Procedures: CAREFULLY PICK UP SPILLS W/NONSPARKING & NONSTATIC PRODUCING TOOLS. SUPERVISION ONLY BY A PERSON KNOWLEDGEABLE IN EXPLOSIVES.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Handling and Storage

Handling and Storage Precautions: NO SMOKING. STORE IN A COOL, DRY PLACE.
Other Precautions: AFFECTED EQUIPMENT MUST BE THOROUGHLY WATER CLEANED BEFORE ATTEMPTING REPAIRS. USE ONLY NONSPARKING TOOLS.

Exposure Controls/Personal Protection

Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN.
Ventilation: NOT REQUIRED IN OPEN, UNCONFINED AREAS.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES.
Other Protective Equipment: METAL FREE & NONSTATIC PRODUCING CLOTHES.
Work Hygienic Practices: WASH HANDS/SHOWER.
Supplemental Safety and Health SPEC GRAV: 1.7-1.82 (H*2O=1).
==== Physical/Chemical Properties ====

Spec Gravity: SUPP DATA
pH: 6-8
Solubility in Water: HIGH
Appearance and Odor: BLACK; NO ODOR.

==== Stability and Reactivity Data ====

Stability Indicator/Materials to Avoid: YES
Stability Condition to Avoid: KEEP AWAY FROM HEAT, SPARKS & OPEN FLAME.
    AVOID IMPACT, FRICTION & STATIC ELECTRICITY.
Hazardous Decomposition Products: NONE SPECIFIED BY MANUFACTURER.

==== Disposal Considerations ====

Waste Disposal Methods: DE-SENSITIZE BY DILUTING IN WATER. OPEN TRAIN
    BURNING OF SMALL UNCONFINED QUANTITIES. ALL PROCEDURES MUST BE IN
    COMPLIANCE W/ALL LOCAL, STATE & FEDERAL REGULATIONS.

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BUCKEYE FIRE EQUIPMENT CO -- CARBON DIOXIDE (CO2) -- 4210-00-203-0217

==== Product Identification ====

Product ID: CARBON DIOXIDE (CO2)
MSDS Date: 12/01/1990
FSC:4210  
NIIN:00-203-0217  
MSDS Number: BXWLF  

=== Responsible Party ===  
Company Name: BUCKEYE FIRE EQUIPMENT CO  
Address: 102 INDUSTRIAL DR  
City: KING'S MOUNTAIN  
State: NC  
ZIP: 28086  
Country: US  
Info Phone Num: 704-739-7415  
Emergency Phone Num: 704-739-7415  
CAGE: 57658  

=== Contractor Identification ===  
Company Name: BUCKEYE FIRE EQUIPMENT CO  
Address: 110 KING'S RD  
Box: 428  
City: KING'S MOUNTAIN  
State: NC  
ZIP: 28086  
Country: US  
Phone: 704-739-7415  
CAGE: 57658  

============== Composition/Information on Ingredients ===============  
Ingred Name: CARBON DIOXIDE  
CAS: 124-38-9  
RTECS #: FF6400000  
Other REC Limits: NONE RECOMMENDED  
OSHA PEL: 5000 PPM  
ACGIH TLV: 5000 PPM/30000 STEL: 95  

================== Hazards Identification ===================  
Routes of Entry: Inhalation: YES  Skin: NO  Ingestion: NO  
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO  
Health Hazards Acute and Chronic: ACUTE: DIRECT CONTACT WITH LIQUID OR  
SOLID WILL CAUSE BURNS, FROSTBITE OR BLINDNESS. CARBON DIOXIDE IS AN  
ASPHYXIANT (DISPLACES OXYGEN). CHRONIC: NONE SPECIFIED BY MANUFACTURER.  
Explanation of Carcinogenicity: NO INGREDIENT OF A CONCENTRATION OF  
0.1%
OR GREATER IS LISTED AS A CARCINOGEN OR SUSPECTED
CARCINOGEN.
Effects of Overexposure: INHALED-SHORTNESS OF BREATH, INCREASED
INHALATION RATE, UNCONSCIOUSNESS, POSSIBLE DEATH. CONTACT
(SKIN,
EYES): BURNS, FROSTBITE, PAIN.
Medical Condition Aggravated by Exposure: NONE KNOWN.

First Aid Measures

First Aid: SKIN/EYES—TREAT AREA EXPOSED TO SOLID OR LIQUID AS
FROSTBITE.
GET IMMEDIATE MEDICAL ATTENTION. INHALED—REMOVE TO FRESH
AIR.
RESTORE BREATHING IF REQUIRED. GET MEDICAL ATTENTION.

Fire Fighting Measures

Extinguishing Media: NONE, THIS MATERIAL IS AN EXTINGUISHING AGENT.
DLA-HMIS: USE MEDIA APPROPRIATE FOR SURROUNDING FIRE.
Fire Fighting Procedures: NONE. DLA-HMIS: WEAR SELF-CONTAINED
BREATHING
APPARATUS AND FULL PROTECTIVE GEAR. COOL FIRE EXPOSED
CONTAINERS
WITH WATER.
Unusual Fire/Explosion Hazard: NONE.

Accidental Release Measures

Spill Release Procedures: RELEASED GAS WILL DISSIPATE RAPIDLY AND
HARMLESSLY TO ATMOSPHERE, IN OPEN AREAS. IN CONFINED OR
ENCLOSED
AREAS, MOVE PERSONNEL AND VENTILATE AREA. VENT TO
ATMOSPHERE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Handling and Storage

Handling and Storage Precautions: STORE AWAY FROM DIRECT HEAT OR
FLAME.
Other Precautions: NONE.
Exposure Controls/Personal Protection

Respiratory Protection: IF ENGINEERING CONTROLS FAIL OR NON-Routine USE OR AN EMERGENCY OCCURS; WEAR AN MSHA/NIOSSH APPROVED AIR-Supplied RESPIRATOR OR SCBA, AS REQUIRED. USE IN ACCORDANCE WITH 29 CFR 1910.134 AND MANUFACTURE R’S RECOMMENDATIONS.
Ventilation: USE ADEQUATE MECHANICAL VENTILATION OR LOCAL EXHAUST TO MAINTAIN EXPOSURE BELOW TLV(S).
Protective Gloves: USE INSULATED GLOVES IF LIQUID OR SOLID.
Eye Protection: SAFETY GLASSES.
Other Protective Equipment: NONE REQUIRED.
Work Hygienic Practices: USE GOOD HYGIENE AND GOOD HOUSEKEEPING PRACTICES.
Supplemental Safety and Health CONTAINS 15 POUNDS, NOMINAL.

Physical/Chemical Properties

HCC: G3
Boiling Pt: B.P. Text: -109F, -78C
Vapor Pres: GAS @ 70F
Vapor Density: 1.52
Evaporation Rate & Reference: HIGH (N-BUTYL ACETATE=1)
Solubility in Water: SLIGHT
Appearance and Odor: COLORLESS LIQUID OR GAS; NO ODOR.

Stability and Reactivity Data

Stability Indicator/Materials to Avoid: YES NONE SPECIFIED BY MANUFACTURER.
Stability Condition to Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products: NONE SPECIFIED BY MANUFACTURER.
Conditions to Avoid Polymerization: WILL NOT OCCUR.

Disposal Considerations

Waste Disposal Methods: DLA-HMIS: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL ENVIRONMENTAL REGULATIONS.

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Product ID: 936 SILICONE LUBE, 50A
MSDS Date: 01/14/1993
FSC: 6850
NIIN: 00N078808
MSDS Number: CGGPN

=== Responsible Party ===
Company Name: AERVOE-PACIFIC CO INC
Address: 1198 SAWMILL RD
City: GARDNERVILLE
State: NV
ZIP: 89410
Country: US
Info Phone Num: 702-782-0100
Emergency Phone Num: 800-424-9300 (CHEMTREC)
Preparer's Name: MIKE A. TRAQUINA
CAGE: 0UPL1

=== Contractor Identification ===
Company Name: AERVOE-PACIFIC CO INC
Address: 1198 SAWMILL RD
Box: City: GARDNERVILLE
State: NV
ZIP: 89410
Country: US
Phone: 702-782-0100
CAGE: 0UPL1

=== Composition/Information on Ingredients ===

Ingred Name: HEXANE; (N-HEXANE) (CERCLA). LD50: (ORAL, RAT) 28710 MG/KG.
CAS: 110-54-3
RTECS #: MN9275000
Fraction by Wt: 30%
OSHA PEL: 500 PPM
ACGIH TLV: 50 PPM
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Ingred Name: VM & P NAPHTHA; (PETROLEUM NAPHTHA). LD50: (ORAL, RAT) >25 MG/KG.
CAS: 64742-89-8
Fraction by Wt: 35%
OSHA PEL: 400 PPM (MFR)
ACGIH TLV: 400 PPM (MFR)

Ingred Name: PROPANE
CAS: 74-98-6
RTECS #: TX2275000
Fraction by Wt: 15%
OSHA PEL: 1000 PPM
ACGIH TLV: ASPHYXIANT

Ingred Name: PROPANE, 2-METHYL-; (ISOBUTANE)
CAS: 75-28-5
RTECS #: TZ4300000
Fraction by Wt: <5%
OSHA PEL: 800 PPM (MFR)
ACGIH TLV: 800 PPM (MFR)

Ingred Name: BUTANE; (NORMAL BUTANE)
CAS: 106-97-8
RTECS #: EJ4200000
Fraction by Wt: 10%
OSHA PEL: 800 PPM
ACGIH TLV: 800 PPM

Ingred Name: VOLATILE ORGANIC COMPOUNDS (COATING): 5.09 LBS/GAL (610 G/L).  
RTECS #: 9999999VO

================================================================================  Hazards Identification  =================================================================================

LD50 LC50 Mixture: SEE INGREDIENTS.
Routes of Entry: Inhalation: YES  Skin: YES  Ingestion: YES
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO
Health Hazards Acute and Chronic: INHALATION: ANESTHETIC, IRRITATION OF THE RESPIRATORY TRACT OR NERVOUS SYSTEM DEPRESSION-CHARACTERIZED BY HEADACHE, DIZZINESS, NAUSEA OR POSSIBLE UNCONSCIOUSNESS.
EYE CONTACT: PRIMARY IRRITATION. SKIN: CONTACT OR ABSORPTION MAY CAUSE IRRITATION OR BURNING SENSATION. PROLONGED OR REPEATED CONTACT MAY CAUSE (EFTS OF OVEREXP)
Explanation of Carcinogenicity: NOT RELEVANT
Effects of Overexposure: HLTH HAZ:DERMATITIS - EXERCISE DUE CARE.
    INGESTION: NOT APPLICABLE.
Medical Cond Aggravated by Exposure: NONE KNOWN.

========================  First Aid Measures  =========================

First Aid:
    INGEST: CALL MD IMMEDIATELY. INHAL: REMOVE FROM EXPOSURE &
    RESTORE BREATHING, SEEK MEDICAL ATTENTION. SKIN: WASH
    AFFECTED AREA.
    REMOVE CONTAMINATED CLOTHING. SEE MD IF ANY IRRITATION
    PERSISTS.
    EYE S: FLUSH IMMEDIATELY W/WATER FOR AT LEAST 15 MINUTES &
    TAKE TO MD.

=====================  Fire Fighting Measures  ======================

Flash Point: -0F, -18C
Lower Limits: 1%
Upper Limits: 9.5%
Extinguishing Media: FOAM, ALCOHOL FOAM, CO2, DRY CHEMICAL, WATER FOG.
Fire Fighting Procedures: USE NIOSH APPROVED SCBA & FULL PROTECTIVE
    EQUIPMENT. WATER SPRAY MAY BE USED TO COOL CONTAINERS
    EXPOSED TO HEAT OR FIRE.
Unusual Fire/Explosion Hazard: CLSD CNTNRS MAY EXPLODE DUE TO BUILD
    UP OF PRESS FROM EXTREME HEAT/FIRE. AEROSOL SPRAY IS
    EXTREMELY FLAMM.
    SENSITIVITY TO IMPACT: DO NOT PUNCTURE. (SUPP DATA)

==================  Accidental Release Measures  ===================

Spill Release Procedures: REMOVE ALL SOURCES OF IGNITION, FLAMES,
    SPARKS, STATIC ELECTRICITY & ELECTRICAL. VENTILATE AREA &
    SOAK UP
    W/INERT ABSORBENT USING NON-SPARKING TYPE TOOLS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

======================  Handling and Storage  =======================
Handling and Storage Precautions: DO NOT STORE ABOVE 120F. DO NOT STORE OR USE NEAR HEAT, SPARKS OR FLAME. DO NOT GET IN EYES. DO NOT BREATHE VAPORS. AVOID SKIN CONTACT.
Other Precautions: DO NOT TAKE INTERNALLY. SMOKING WHILE USING THIS PRODUCT MUST BE STRICTLY PROHIBITED. AVOID PROLONGED OR REPEATED CONTACT.

============= Exposure Controls/Personal Protection =============
Respiratory Protection: IN RESTRICTED AREAS W/POOR VENTILATION USE A NIOSH APPROVED RESPIRATOR W/ORGANIC VAPOR CARTRIDGE.
Ventilation: ALL APPLICATION AREAS SHOULD BE ADEQUATELY VENTILATED IN ORDER TO KEEP INGREDIENTS BELOW THEIR EXPOSURE LIMITS.
Protective Gloves: IMPERVIOUS GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS.
Other Protective Equipment: EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA. IMPERVIOUS APRON IS REC TO PREVENT SKIN CONT.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.

================= Physical/Chemical Properties =================
Boiling Pt: B.P. Text: 10F, -12C
Vapor Density: HVR/AIR
Spec Gravity: 0.7 (H*2O=1)
Evaporation Rate & Reference: FASTER/N-BUTYL ACETATE
Solubility in Water: NEGLIGIBLE
Appearance and Odor: CLEAR LIQUID; SOLVENT BASED ODOR.

============= Stability and Reactivity Data ==============
Stability Indicator/Materials to Avoid: YES STRONG OXIDIZING AGENTS.
Stability Condition to Avoid: HIGH TEMPERATURES.
Hazardous Decomposition Products: CARBON MONOXIDE & CARBON DIOXIDE.

==================== Disposal Considerations ===================

Waste Disposal Methods: DISPOSE OF I/A/W LOCAL, STATE & FEDERAL REGULATIONS. DO NOT INCINERATE CLOSED CONTAINERS.

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BOWMAN DISTRIBUTION, BANRES GROUP INC -- 21911 WHITE LUBE LITHIUM GREASE -- 9150-00F014116
================================= Product Identification =================================

Product ID:21911 WHITE LUBE LITHIUM GREASE
MSDS Date:10/18/1988
FSC:9150
NIIN:00F014116
MSDS Number: BJTPZ

=== Responsible Party ===
Company Name:BOWMAN DISTRIBUTION, BANRES GROUP INC
Address:850 EAST 72ND STREET
City:CLEVELAND
State:OH
ZIP:44103
Info Phone Num:(216) 391-7200
Emergency Phone Num:(216) 391-7200
CAGE:05575

=== Contractor Identification ===
Company Name:BOWMAN DISTRIBUTION, BARNES GROUP INC
Address:1301 EAST 9TH ST, SUITE 700
Box:City:CLEVELAND
State:OH
ZIP:44114-1824
Country:US
Phone:216-416-7200
CAGE:05573

Company Name:BOWMAN DISTRIBUTION, BARNES GROUP INC.
Address:850 EAST 72ND STREET
City:CLEVELAND
State:OH
ZIP:44103
Phone:(216) 391-7200
CAGE:05575

============= Composition/Information on Ingredients =============

Ingred Name:METHYL CHLOROFORM (1,1,1-TRICHLOROEHANE) (SARA III)
CAS:71-55-6
RTECS #:KJ2975000
Fraction by Wt: 15.0%
Other REC Limits: 350 PPM (CL)
OSHA PEL: 350 PPM/450 STEL
ACGIH TLV: 350 PPM/450 STEL; 9192
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS
Ozone Depleting Chemical: 1

Ingred Name: HEXANE (N-HEXANE)
CAS: 110-54-3
RTECS #: MN9275000
Fraction by Wt: 22.0%
Other REC Limits: 50 PPM
OSHA PEL: 500 PPM
ACGIH TLV: 50 PPM; 9293
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Ingred Name: GREASE
Fraction by Wt: 38.0%

Ingred Name: ISOBUTANE, 2-METHYLPROPANE
CAS: 75-28-5
RTECS #: TZ4300000
Fraction by Wt: <25.0%
Other REC Limits: 1000 PPM
OSHA PEL: 1800 MG/CUM
ACGIH TLV: 1000 PPM

Ingred Name: PROPANE
CAS: 74-98-6
RTECS #: TX2275000
Fraction by Wt: <25.0%
Other REC Limits: 1800 MG/CUM
OSHA PEL: 1000 PPM
ACGIH TLV: ASPHYXIANT; 9192

========================== Hazards Identification ==========================

Routes of Entry: Inhalation: YES  Skin: YES  Ingestion: YES
Reports of Carcinogenicity: NTP: NO  IARC: NO  OSHA: NO
Health Hazards Acute and Chronic: INHALATION: DIZZINESS OR NARCOSIS.
   SKIN: DEFATTING, EFFECTS ARE REVERSIBLE. LONG TERM
EXPOSURE VAPOR
   MAY CAUSE LUNG, LIVER OR KIDNEY DAMAGE. THE SOLVENTS LISTED
HAVE
BENEFIT REPORTED TO AFFECT THE CENTRAL NERVOUS SYSTEM.

INGESTION:
HARMFUL.

Explanation of Carcinogenicity:
NONE

Effects of Overexposure:
INHALATION: DIZZINESS, NARCOSIS. SKIN:
DEFATTING, EFFECTS ARE REVERSIBLE. LONG TERM EXPOSURE
VAPOR MAY
CAUSE LUNG, LIVER OR KIDNEY DAMAGE. THE SOLVENTS LISTED
HAVE BEEN
REPORTED TO AFFECT THE CENTRAL NERVOUS SYSTEM. INGESTION:
HARMFUL.

Medical Cond Aggravated by Exposure:
HEART DISEASE, RESPIRATORY DISORDER.

=================================  First Aid Measures  ==================================

First Aid:
INHALATION: IF UNCONSCIOUS, REMOVE PERSON TO FRESH AIR. EYES:
FLUSH W/LARGE QUANTITIES OF WATER. OBTAIN MEDICAL ATTENTION IN ALL CASES.

=================================  Fire Fighting Measures  ==================================

Flash Point Method:
TCC
Flash Point:
-40F
Lower Limits:
1.8%
Upper Limits:
12.0%

Extinguishing Media:
WATERFOG, FOAM, CO2, OR DRY CHEMICAL

Fire Fighting Procedures:
KEEP CONTAINERS COOL. USE EQUIPMENT OR SHIELDING REQUIRED TO PROTECT PERSONNEL AGAINST BURSTING OR VENTING CONTAINERS.

Unusual Fire/Explosion Hazard:
AT ELEVATED TEMPERATURES >130F CONTAINERS
MAY VENT, RUPTURE OR BURST.

=================================  Accidental Release Measures  ==================================

Spill Release Procedures:
USE ABSORBENT SWEEPING COMPOUND TO SOAK UP MATERIAL. PUT INTO CONTAINER. DISPOSE AS HAZARDOUS WASTE.

=================================  Handling and Storage  ==================================
Critical Design Review Report

Windward Community College – University of Hawaii 2009-2010

Handling and Storage Precautions: DON'T STORE AT TEMPERATURES >120F.
Other Precautions: NONE

=================================

Exposure Controls/Personal Protection

Respiratory Protection: AVOID BREATHING CONCENTRATED VAPORS OR PARTICLES
FROM ALL PRODUCTS NOT SPECIFICALLY DESIGNED TO BE INHALED.
Ventilation: LOCAL EXHAUST: NORMAL USE-NORMAL VENTILATION
Eye Protection: SAFETY GLASSES REQUIRED
Other Protective Equipment: LONG SLEEVES/PANTS.

Supplemental Safety and Health

Physical/Chemical Properties

Boiling Pt: B.P. Text: -40 - >600F
Vapor Pres: 55 PSI
Vapor Density: 4.0
Spec Gravity: 0.8
pH: NONE
Appearance and Odor: LIQUID GAS, WHITE & SOLVENT ODOR.
Percent Volatiles by Volume: 60.0%

Stability and Reactivity Data

Stability Indicator/Materials to Avoid: YES
Stability Condition to Avoid: PRESSURIZED CONTAINERS COULD RUPTURE >130F.
Hazardous Decomposition Products: CO, CO2, WATER, PHOSGENE & HALOGEN ACIDS.

Disposal Considerations

Waste Disposal Methods: DON'T PUNCTURE OR INCINERATE CONTAINERS.
DISPOSE AS HAZARDOUS WASTE IN ACCORDANCE W/EPA RCRA. CONSUMER COMMODITY, ORM-D, UN 1954. RCRA HAZARDOUS WASTE: D001.

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particular situation.

CHESTER LABORATORIES -- ISOPROPYL RUBBING ALCOHOL, USP --
6810-00-311-0192
======================  Product Identification  =====================

Product ID:ISOPROPYL RUBBING ALCOHOL, USP
MSDS Date:08/20/1993
FSC:6810
NIIN:00-311-0192
MSDS Number: CHHNG
=== Responsible Party ===
Company Name:CHESTER LABORATORIES
Address:3208 DIXIE HWY
City:ERLANGER
State:KY
ZIP:41018
Country:US
Info Phone Num:800-354-9709
Emergency Phone Num:606-578-4550
Preparer's Name:KENNETH P. REED, PH.D,CIH
CAGE:JO149

=== Contractor Identification ===
Company Name:CHESTER LABORATORIES
Box:UNKNOW
CAGE:87879
Company Name:CHESTER LABORATORY INC
Address:3208 DIXIE HIGHWAY
Box:City:ERLANGER
State:KY
ZIP:41018-1876
Country:US
Phone:606-341-7972
CAGE:JO149
Company Name:ROCHESTER MIDLAND CORP, INDUSTRIAL DIV
Address:321 COMMERCIAL AVE
Box:City:PALISADES PARK
State:NJ
ZIP:07650
Country:US
Phone: 201-947-9880
CAGE: 0D8W2

============= Composition/Information on Ingredients =============

Ingred Name: ISOPROPYL ALCOHOL (SARA III)
CAS: 67-63-0
RTECS #: NT8050000
Fraction by Wt: 70%
Other REC Limits: NONE SPECIFIED
OSHA PEL: 400 PPM/500 STEL
ACGIH TLV: 400 PPM/500 STEL; 9192

====================== Hazards Identification =====================

LD50 LC50 Mixture: TLV = 400 PPM
Routes of Entry: Inhalation: YES  Skin: NO  Ingestion: YES
OSHA: NO
Health Hazards Acute and Chronic: ACUTE: OVEREXPOSURE MAY LEAD TO CENTRAL NERVOUS SYSTEM DEPRESSION, LEADING TO HEADACHES AND DIZZINESS. EYE: MAY LEAD TO IRRIGATION AND WILL INJURE EYE TISSUE IF NOT REMOVED PROMPTLY. SKIN: MAY LEAD TO DERMATITIS. INGESTION: MAY LEAD TO VOMITING. CHRONIC: PROLONGED SKIN CONTACT MAY CAUSE DERMATITIS.

Explanation of Carcinogenicity: THIS CHEMICAL IS NOT LISTED AS HAVING ANY EVIDENCE OF BEING CARCINOGENIC.

Effects of Overexposure: OVEREXPOSURE MAY LEAD TO DIZZINESS, HEADACHES, DERMATITIS AND EYE IRRITATION. HIGH VAPOR CONCENTRATIONS ARE ANESTHETIC AND MAY HAVE OTHER CENTRAL NERVOUS SYSTEM EFFECTS, SUCH AS LIGHTHEADEDNESS, HEADACHE AND DIZZINESS.

Medical Cond Aggravated by Exposure: PERSONS WITH SKIN, HEART, RESPIRATORY, OR ANY OTHER MEDICAL CONDITION SHOULD USE CAUTION WHEN HANDLING OR USING THIS PRODUCT.

====================== First Aid Measures =====================
First Aid: SKIN: IMMEDIATELY FLUSH WITH SOAP AND WATER. GET MEDICAL ATTENTION IF NECESSARY. INHALATION: IMMEDIATELY REMOVE VICTIM TO FRESH AIR. GIVE CPR IF BREATHING HAS STOPPED. GET MEDICAL ATTENTION. EYE: IMMEDIATELY FLUSH WITH WATER FOR 15 MINUTES. GET MEDICAL ATTENTION. INGESTION: GET PROMPT MEDICAL ATTENTION. DO NOT INDUCE VOMITING. KEEP AT REST.

--------------------- Fire Fighting Measures ---------------------

Flash Point Method: SCC
Flash Point: 53.0°F, 11.7°C
Lower Limits: 2
Upper Limits: 13
Extinguishing Media: USE FOAM, OR DRY CHEMICAL. USE WATER SPRAY TO COOL
  FIRE EXPOSED CONTAINERS AND TO PROTECT PERSONNEL.
Fire Fighting Procedures: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF CONTAINED BREATHING APPARATUS.
Unusual Fire/Explosion Hazard: COMBUSTION OR HEAT OF FIRE MAY PRODUCE HAZARDOUS DECOMPOSITION PRODUCTS AND VAPORS. VAPORS HEAVIER THAN AIR, CAN TRAVEL ALONG GROUND AND FLASHBACK.

--------------------- Accidental Release Measures ---------------------

Spill Release Procedures: VENTILATE. ELIMINATE IGNITION SOURCES. ABSORB MATERIAL WITH CLAY, VERMICULITE, OR SIMILAR ABSORBENT MATERIAL. PLACE IN DISPOSAL CONTAINERS. FLUSH AREA WITH WATER.

---------------------------- Handling and Storage -----------------------------

Handling and Storage Precautions: USE ONLY IN WELL VENTILATED WORK AREA.
  KEEP CONTAINERS CLOSED WHEN NOT IN USE. FLAMMABLE LIQUID.
  DO NOT STORE ABOVE 120°F.
Other Precautions: DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. EXPLOSION HAZARD.

================== Exposure Controls/Personal Protection ==================

Respiratory Protection: NONE NORMALLY REQUIRED. USE NIOSH/MSHA APPROVED RESPIRATOR. AIR-SUPPLIED OR FILTERING TYPE WITH ORGANIC VAPOR CARTRIDGES IF TLV IS EXCEEDED.

Ventilation: LOCAL AND MECHANICAL EXHAUST RECOMMENDED. AVOID OPEN ELECTRICAL SOURCES NEAR PRODUCT VAPOR AREAS.

Protective Gloves: NEOPRENE, NITRILE, OR POLYVINYL ALCOHOL
Eye Protection: USE CHEMICAL SAFETY GOGGLES & FACESHIELD
Other Protective Equipment: SAFETY SHOES, EYE WASH STATION AND SHOWER.

Work Hygienic Practices: DO NOT TAKE INTERNALLY. AVOID SKIN CONTACT. WASH SKIN AFTER USING PRODUCT. DO NOT EAT, DRINK OR SMOKE IN WORK AREA.

Supplemental Safety and Health
NONE

================== Physical/Chemical Properties ==================

HCC: F2
Boiling Pt: B.P. Text: 194F, 90C
Vapor Pres: 38
Vapor Density: 2.0
Spec Gravity: 0.82
Evaporation Rate & Reference: 2.8 (BUTYL ACETATE = 1)
Solubility in Water: 100%
Appearance and Odor: CLEAR, COLORLESS LIQUID WITH AN ALCOHOL ODOR.

Stability Indicator/Materials to Avoid: YES
STRONG OXIDIZING AGENTS, REACTIVE ALKALI METALS.
Stability Condition to Avoid: HIGH HEAT, OPEN FLAMES AND OTHER SOURCES
  OF IGNITION. ALSO AVOID VAPOR ACCUMULATION.
Hazardous Decomposition Products: CARBON MONOXIDE, CARBON DIOXIDE,
  INCOMPLETELY BURNED CARBON PRODUCTS.

=================== Disposal Considerations ====================
Waste Disposal Methods: DISPOSE OF ALL WASTE IN ACCORDANCE WITH LOCAL,
  STATE AND FEDERAL REGULATIONS. INCINERATION IS RECOMMENDED.

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Appendix B: NAR / TRA Regulations

Source: http://www.tripoli.org/documents/safety_code.shtml

The Tripoli High Power Safety Code is based on NFPA 1127. You may view the current version of NFPA 1127 on the NFPA Website.

Only a person who is a certified flyer shall operate or fly a high power rocket. Must comply with United States Code 1348, "Airspace Control and Facilities", Federal Aviation Act of 1958 and other applicable federal, state, and local laws, rules, regulations, statutes, and ordinances.

A person shall fly a high power rocket only if it has been inspected and approved for flight by a Safety Monitor for compliance with the applicable provisions of this code.

Motors

Use only certified commercially made rocket motors.

Do not dismantle, reload, or alter a disposable or expendable high power rocket motor, not alter the components of a reloadable high power rocket motor or use the contents of a reloadable rocket motor reloading kit for a purpose other than that specified by the manufacture in the rocket motor or reloading kit instructions.

A high power rocket shall be constructed to withstand the operating stresses and retain structural integrity under conditions expected or known to be encountered in flight.

A high power rocket vehicle intended to be propelled by one or more high power solid propellant rocket motor(s) shall be constructed using lightweight materials such as paper, wood, plastic, fiberglass, or, when necessary, ductile metal so that the rocket conforms to the other requirements of this code.

A person intending to operate a high power rocket shall determine its stability before flight, providing documentation of the location of the center of pressure and center of gravity of the high power rocket to the Safety Monitor, if requested.

Weight and Power Limits.

Ensure that the rocket weighs less than the rocket motor manufacturer's recommended maximum liftoff weight for the rocket motor(s) used for the flight. During pre-flight inspection, The Safety Monitor may request documentary proof of compliance.

Do not install a rocket motor or combination of rocket motors that will produce more than 40,960 newton-seconds of total impulse (4.448 newtons equals 1.0 pound).

Recovery.

Fly a high power rocket only if it contains a recovery system that will return all parts of it safely to the ground so that it may be flown again.
Install only flame resistant recovery wadding if wadding is required by the design of the rocket.

Do not attempt to catch a high power rocket as it approaches the ground.

Do not attempt to retrieve a high power rocket from a place that is hazardous to people.

**Payloads**

- Do not install or incorporate in a high power rocket a payload that is intended to be flammable, explosive, or cause harm.
- Do not fly a vertebrate animal in a high power rocket.

**Launching Devices**

- Launch from a stable device that provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path.
- Incorporate a jet deflector device if necessary to prevent the rocket motor exhaust from impinging directly on flammable materials.
- A launching device shall not be capable of launching a rocket at an angle more than 20 degrees from vertical.
- Place the end of the launch rod or rail above eye level or cap it to prevent accidental eye injury. Store the launch rod or rail so it is capped, cased, or left in a condition where it cannot cause injury.

**Ignition Systems**

- Use an ignition system that is remotely controlled, electrically operated, and contains a launching switch that will return to "off" when released.
- The ignition system shall contain a removable safety interlock device in series with the launch switch.
- The launch system and igniter combination shall be designed, installed, and operated so the liftoff of the rocket shall occur within three (3) seconds of actuation of the launch system. If the rocket is propelled by a cluster of rocket motors designed to be ignited simultaneously, install an ignition scheme that has either been previously tested or has a demonstrated capability of igniting all rocket motors intended for launch ignition within one second following ignition system activation.
- Install an ignition device in a high power rocket motor only at the launch site and at the last practical moment before the rocket is placed on the launcher.

**Launch Site**

- Launch a high power rocket only in an outdoor area where tall trees, power lines, and buildings will not present a hazard to the safe flight operation of a high power rocket in the opinion of the Safety Monitor.
- Do not locate a launcher closer to the edge of the flying field (launch site) than one-half the radius of the minimum launch site dimension.
- The flying field (launch site) shall be at least as large as the stated in...
Table 1. or Not less than one-half the maximum altitude expected, calculated, or simulated, or as granted by an FAA waiver or the authority having jurisdiction.

**Launcher Location**
Locate the launcher more than 1,500 feet from any occupied building. Ensure that the ground for a radius of 10 feet around the launcher is clear of brown grass, dry weeds, or other easy-to-burn materials that could be ignited during launch by the exhaust of the rocket motor.

**Safe Distances**
No person shall be closer to the launch of a high power rocket than the person actually launching the rocket and those authorized by the Safety Monitor.

All spectators shall remain within an area determined by the Safety Monitor and behind the Safety Monitor and the person launching the rocket.

A person shall not be closer to the launch of a high power rocket than the applicable minimum safe distance set forth in Table 2.

**Launch Operations**
Do not ignite and launch a high power rocket horizontally, at a target, or so the rocket's flight path goes into clouds or beyond the boundaries of the flying field (launch site).

Do not launch a high power rocket if the surface wind at the launcher is more than twenty (20) miles per hour.

Do not operate a high power rocket in a manner that is hazardous to aircraft.

**Launch Control**
Launch a high power rocket only with the immediate knowledge, permission, and attention of the Safety Monitor.

All persons in the launching, spectator, and parking areas during a countdown and launch shall be standing and facing the launcher if requested to do so by the Safety Monitor.

Precede the launch with a five (5) second countdown audible throughout the launching, spectator, and parking areas. This countdown shall be given by the person launching the rocket, the Safety Monitor, or other flying site operating personnel.

Do not approach a high power rocket that has misfired until the safety inter-lock has been removed or the battery has been disconnected from the ignition system, one minute has passed, and the Safety Monitor has given permission for only a single person to approach the misfired rocket to inspect it.

<table>
<thead>
<tr>
<th>Installed Total Impulse (N-sec)</th>
<th>Equivalent Motor Type</th>
<th>Minimum Site Distance (feet)</th>
<th>Equivalent Distance (miles)</th>
</tr>
</thead>
</table>

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### TABLE 1: LAUNCH SITE DIMENSIONS

<table>
<thead>
<tr>
<th>Installed Total Impulse (N-sec)</th>
<th>Equivalent Motor Type</th>
<th>Minimum Safe Distance (feet)</th>
<th>Complex Minimum Safe Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160.01 - 320.00</td>
<td>H</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>320.01 - 640.00</td>
<td>I</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>640.01 - 1280.00</td>
<td>J</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>1280.01 - 2560.00</td>
<td>K</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>2560.01 - 5120.00</td>
<td>L</td>
<td>1,000</td>
<td>1,500</td>
</tr>
<tr>
<td>5120.01 - 10240.00</td>
<td>M</td>
<td>2,000</td>
<td>2,500</td>
</tr>
<tr>
<td>10240.01 - 20480.00</td>
<td>N</td>
<td>3,000</td>
<td>3,500</td>
</tr>
<tr>
<td>20480.01 - 40960.00</td>
<td>O</td>
<td>4,000</td>
<td>4,500</td>
</tr>
</tbody>
</table>

### TABLE 2: SAFE DISTANCE

<table>
<thead>
<tr>
<th>Installed Total Impulse (N-sec)</th>
<th>Equivalent Motor Type</th>
<th>Minimum Safe Distance (feet)</th>
<th>Complex Minimum Safe Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160.01 - 320.00</td>
<td>H</td>
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<td>10240.01 - 20480.00</td>
<td>N</td>
<td>3,000</td>
<td>3,500</td>
</tr>
<tr>
<td>20480.01 - 40960.00</td>
<td>O</td>
<td>4,000</td>
<td>4,500</td>
</tr>
</tbody>
</table>

### NAR Regulations

Source: [http://www.nar.org/NARhpsc.html](http://www.nar.org/NARhpsc.html)

High Power Rocket Safety Code

**Certification.** I will only fly high power rockets or possess high power rocket motors that are within the scope of my user certification and required licensing.

**Materials.** I will use only lightweight materials such as paper, wood, rubber, plastic, fiberglass, or when necessary ductile metal, for the construction of my rocket.

**Motors.** I will use only certified, commercially made rocket motors, and will not tamper with these motors or use them for any purposes except those...
recommended by the manufacturer. I will not allow smoking, open flames, nor heat sources within 25 feet of these motors.

**Ignition System.** I will launch my rockets with an electrical launch system, and with electrical motor igniters that are installed in the motor only after my rocket is at the launch pad or in a designated prepping area. My launch system will have a safety interlock that is in series with the launch switch that is not installed until my rocket is ready for launch, and will use a launch switch that returns to the "off" position when released. If my rocket has onboard ignition systems for motors or recovery devices, these will have safety interlocks that interrupt the current path until the rocket is at the launch pad.

**Misfires.** If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher’s safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

**Launch Safety.** I will use a 5-second countdown before launch. I will ensure that no person is closer to the launch pad than allowed by the accompanying Minimum Distance Table, and that a means is available to warn participants and spectators in the event of a problem. I will check the stability of my rocket before flight and will not fly it if it cannot be determined to be stable.

**Launcher.** I will launch my rocket from a stable device that provides rigid guidance until the rocket has attained a speed that ensures a stable flight, and that is pointed to within 20 degrees of vertical. If the wind speed exceeds 5 miles per hour I will use a launcher length that permits the rocket to attain a safe velocity before separation from the launcher. I will use a blast deflector to prevent the motor’s exhaust from hitting the ground. I will ensure that dry grass is cleared around each launch pad in accordance with the accompanying Minimum Distance table, and will increase this distance by a factor of 1.5 if the rocket motor being launched uses titanium sponge in the propellant.

**Size.** My rocket will not contain any combination of motors that total more than
40,960 N·sec (9208 pound-seconds) of total impulse. My rocket will not weigh more at liftoff than one-third of the certified average thrust of the high power rocket motor(s) intended to be ignited at launch.

**Flight Safety.** I will not launch my rocket at targets, into clouds, near airplanes, nor on trajectories that take it directly over the heads of spectators or beyond the boundaries of the launch site, and will not put any flammable or explosive payload in my rocket. I will not launch my rockets if wind speeds exceed 20 miles per hour. I will comply with Federal Aviation Administration airspace regulations when flying, and will ensure that my rocket will not exceed any applicable altitude limit in effect at that launch site.

**Launch Site.** I will launch my rocket outdoors, in an open area where trees, power lines, buildings, and persons not involved in the launch do not present a hazard, and that is at least as large on its smallest dimension as one-half of the maximum altitude to which rockets are allowed to be flown at that site or 1500 feet, whichever is greater.

**Launcher Location.** My launcher will be 1500 feet from any inhabited building or from any public highway on which traffic flow exceeds 10 vehicles per hour, not including traffic flow related to the launch. It will also be no closer than the appropriate Minimum Personnel Distance from the accompanying table from any boundary of the launch site.

**Recovery System.** I will use a recovery system such as a parachute in my rocket so that all parts of my rocket return safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.

**Recovery Safety.** I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places, fly it under conditions where it is likely to recover in spectator areas or outside the launch site, nor attempt to catch it as it approaches the ground.

Revision of July 2008
## Appendix C: Hazard Mitigations

In addition to all the mitigation tactics listed below the team will always maintain good hygiene and a clean work environment.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Risk</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenolic Powder-Black</td>
<td>Ingestion Hazards, Skin Irritation, Eye Irritation</td>
<td>Team members will work in well-ventilated areas and wear face masks at all times to prevent inhalation and ingestion of the dust from the Phenolic Black Powder. Gloves will be worn at all times to prevent skin irritation. Goggles will be worn at all times to prevent eye irritation.</td>
</tr>
<tr>
<td>Phenolic Resin</td>
<td>Toxic Fumes, Skin Irritation, Eye Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent Eye Irritation</td>
</tr>
<tr>
<td>Copperhead igniter</td>
<td>Ingestion Hazards, Toxic Fumes, Skin Irritation, Eye Irritation, Inadvertent Ignition, Burns to skin</td>
<td>Team members will work in well-ventilated areas and wear face masks at all times to prevent inhalation and ingestion of hazardous chemicals. Gloves will be worn at all times to prevent skin irritation and burns to skin. Goggles will be worn at all times to prevent eye irritation. Igniters will be kept away from ignition sources such as flames, matches, and heat sources, and will be properly stored in Type 3 or Type 4 magazines to prevent inadvertent ignition.</td>
</tr>
<tr>
<td>IGNITER TYPE</td>
<td>INDUCED HAZARDS</td>
<td>PREVENTIVE MEASURES</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>FirstFire Igniter</td>
<td>Ingestion Hazards, Toxic Fumes, Skin Irritation, Eye Irritation, Inadvertent Ignition, Burns to skin</td>
<td>Team members will work in well-ventilated areas and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of hazardous chemicals. Gloves will be worn at all times to prevent skin irritation and burns to skin. Goggles will be worn at all times to prevent eye irritation. Igniters will be kept away from ignition sources such as flames, matches, and heat sources, and will be properly stored in Type 3 or Type 4 magazines to prevent inadvertent ignition.</td>
</tr>
<tr>
<td>FirstFire Jr Igniter</td>
<td>Ingestion Hazards, Toxic Fumes, Skin Irritation, Eye Irritation, Inadvertent Ignition, Burns to skin</td>
<td>Team members will work in well-ventilated areas and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of hazardous chemicals. Gloves will be worn at all times to prevent skin irritation and burns to skin. Goggles will be worn at all times to prevent eye irritation. Igniters will be kept away from ignition sources such as flames, matches, and heat sources, and will be properly stored in Type 3 or Type 4 magazines to prevent inadvertent ignition.</td>
</tr>
<tr>
<td>Rocket Propellant</td>
<td>Skin Irritation, Inadvertent Ignition, Burns to skin</td>
<td>Gloves will be worn at all times to prevent skin irritation. Propellant will be kept away from ignition sources, such as flames, matches, igniters, heat sources, and will be properly stored in Type 3 or Type 4 magazines to prevent inadvertent ignition. After motor burn, the team will wait 15 minutes before disassembling the motor, while wearing insulated gloves to prevent burns to skin.</td>
</tr>
<tr>
<td>Material</td>
<td>Hazards</td>
<td>Safety Measures</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Epoxy Resin</td>
<td>Toxic Fumes, Skin Irritation, Eye Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent Eye Irritation</td>
</tr>
<tr>
<td>5-Minute Epoxy Resin</td>
<td>Toxic Fumes, Skin Irritation, Eye Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent Eye Irritation</td>
</tr>
<tr>
<td>Sinmast 4 Epoxy Mortar Mix - Normal Cure</td>
<td>Ingestion Hazards, Skin Irritation, Eye Irritation</td>
<td>Team Members will wear face masks at all times to prevent ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent Eye Irritation</td>
</tr>
<tr>
<td>Compressed Carbon Fiber Sheets</td>
<td>Inhalation Hazards, Eye Irritation, Skin Irritation</td>
<td>Team Members will wear face masks at all times to prevent inhalation of the material. Goggles will be worn at all times to prevent Eye Irritation. Gloves will be worn at all times to prevent skin irritation</td>
</tr>
<tr>
<td>Fiber Glass Cloth</td>
<td>Inhalation Hazards, Eye Irritation, Skin Irritation</td>
<td>Team Members will wear face masks at all times to prevent inhalation of the material. Goggles will be worn at all times to prevent Eye Irritation. Gloves will be worn at all times to prevent skin irritation</td>
</tr>
<tr>
<td>Material</td>
<td>Hazards</td>
<td>Precautions</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Polystyrene</td>
<td>Ingestion Hazards</td>
<td>Team Members will wear face masks at all times to prevent Ingestion of Material</td>
</tr>
<tr>
<td>Polystyrene Foam</td>
<td>Ingestion Hazards, Skin Irritation, Eye Irritation</td>
<td>Team Members will wear face masks at all times to prevent Ingestion of Material. Goggles will be worn at all times to prevent eye irritation</td>
</tr>
<tr>
<td>Duct Tape</td>
<td>Skin Irritation, Eye Irritation</td>
<td>Team members will avoid prolonged exposure of duct tape to bare skin to prevent skin irritation. Team members will not place duct tape on their eyes to prevent eye irritation</td>
</tr>
<tr>
<td>Masking Tape</td>
<td>No Risks Stated</td>
<td></td>
</tr>
<tr>
<td>Super Glue</td>
<td>Toxic Fumes, Ingestion Hazards, Eye Irritation, Skin Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with. Goggles will be worn at all times to prevent eye irritation.</td>
</tr>
<tr>
<td>Acetone</td>
<td>Toxic Fumes, Ingestion Hazards, Eye Irritation, Skin Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with. Goggles will be worn at all times to prevent eye irritation.</td>
</tr>
<tr>
<td>Material</td>
<td>Hazards</td>
<td>Precautions</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Mineral Spirits</td>
<td>Severe Eye Irritation, Skin irritation, Ingestion hazards</td>
<td>Team Members will wear face masks at all times to prevent Ingestion of the material. Gloves will be worn at all times to prevent skin irritation. Goggles will be worn at all times to prevent eye irritation.</td>
</tr>
<tr>
<td>Denatured Alcohol</td>
<td>Toxic Fumes, Ingestion Hazards, Eye Irritation</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Goggles will be worn at all times to prevent eye irritation.</td>
</tr>
<tr>
<td>Black Powder</td>
<td>Inhalation Hazards, Eye Irritation, Inadvertent Ignition, Burns to skin</td>
<td>Team Members will wear face masks at all times to prevent Inhalation of the Black Powder. The Black Powder will be kept away from ignition sources such as flames, matches, and heat source to prevent inadvertent ignition. Gloves will be worn to prevent burns to skin. Goggles will be worn at all times to protect eyes. Equipment used with or near the Black Powder will be nonstatic producing materials to prevent inadvertent ignition.</td>
</tr>
<tr>
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<tr>
<td>----------------</td>
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<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Inhalation Hazards</td>
<td>Team members will work in a well-ventilated area to prevent inhalation hazards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicone Lube</td>
<td>Ingestion Hazards, Skin Irritation, Eye Irritation, Toxic Fumes</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent eye irritation</td>
</tr>
<tr>
<td>White Lithium Grease</td>
<td>Ingestion Hazards, Skin Irritation, Eye Irritation, Toxic Fumes</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Gloves and chemical resistant aprons will be worn at all times to prevent Skin Irritation and contact with clothing. Goggles will be worn at all times to prevent eye irritation</td>
</tr>
<tr>
<td>Isopropyl Rubbing Alcohol</td>
<td>Toxic Fumes, Ingestion Hazards, Eye Irritation, Inadvertent Ignition, Burns to Skin</td>
<td>Team Members will work in a well-ventilated area and wear face masks at all times to prevent inhalation of toxic fumes and ingestion of the material. Goggles will be worn at all times to prevent contact with eyes leading to eye irritation. Material will be kept away from ignition sources, such as flames, matches, igniters, heat sources.</td>
</tr>
</tbody>
</table>
Team members will wear gloves to protect from burns to skin in the event of an inadvertent ignition.