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Dryden Centerwide Procedure

Code S

Communication of Chemical Hazards

This Chapter Contains Hazardous Operations.

Electronically approved by
Assistant Director for Management Systems

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1.0 PURPOSE OF DOCUMENT

This document describes procedures and guidelines, delegates authority, and assigns responsibility for communicating chemical hazard information at DFRC. It is commonly referred to as the Hazard Communication Program (HCP).

2.0 PROCEDURE SCOPE & APPLICABILITY

Scope: This procedure applies to hazards associated with chemicals. Throughout this document, the use of the word chemicals is intended to include both pure chemicals and chemical products, which includes mixtures of chemicals designed for a specific purpose (e.g., paints, sealants, adhesives, lubricants, etc.).

Scope Exception: This procedure does not cover the following:

A. Hazardous Waste Disposal – Hazardous waste disposal is conducted in compliance with the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, and other applicable regulations.

B. Consumer Items – Items such as tobacco, wood products, foods, drugs, or cosmetics intended for personal use, consumer substances, and those excluded by 29 CFR 1910.1200, which do not expose employees to hazards when used under normal conditions.

Applicability: This procedure applies to people working with or around chemicals.

3.0 PROCEDURE OBJECTIVES, TARGETS, METRICS, & TREND ANALYSIS

Objective: Eliminate or control potential hazards when handling hazardous chemicals.

Target: Zero mishaps resulting from the mishandling of hazardous chemicals.

Metric: Number of mishaps resulting from mishandling hazardous chemicals.

Trend analysis: Metrics will be analyzed to determine whether procedural objectives have been met.

4.0 WAIVER AUTHORITY

Requests for waivers and variances to this procedure will be made to the Chief, Safety, Health, and Environmental Office (Code SH). Requests for waivers and variances to NASA safety instructions will be made to NASA HQ in accordance with instructions provided by NPR 8715.3, NASA Safety Manual, Section 1-19, Safety Variance Process, and Table 1-1, NASA Safety Risk and Approval Process Matrix.

5.0 RESPONSIBILITIES

5.1 Directorates & Single Letter Organizations

Ensure the HCP is implemented within their area of responsibility.

5.2 Safety, Health, & Environmental (SH&E) Office

The SH&E Office has oversight responsibility for the DFRC HCP and incurs the following duties:

A. Advise management on matters concerning hazard communications.

B. Ensure that an HCP is developed and distributed to users.

C. Ensure the Material Safety Data Sheet (MSDS) master file is complete for chemicals listed in the latest master hazardous chemicals inventory. Provide changes to existing MSDSs to users.

D. Provide basic hazard communication training.

E. Assist supervisors in the preparation of safety procedures and training directives for hazardous chemicals used by their employees.

F. Investigate hazardous material accidents and incidents and report findings to management and required agencies.

G. Review chemical requests in the Hazardous Material Management System (HMMS) and new MSDSs to ensure adequate information is provided.

H. Perform audits at least annually to evaluate compliance with this HCP.

5.3 Supervisors

(Of work areas where hazardous chemicals are used or stored)

Supervisors may delegate responsibility (in writing) to manage the HCP to a person or persons within the work area (e.g., laboratory, hangar or shop).

A. Ensure the implementation of the HCP within their area of responsibility.

B. Perform review of the work area hazard communication plan and document findings at least annually.

C. At least annually, download from HMMS the current inventory of Hazardous Chemicals used within the work area. The hazardous chemicals list must be kept in the MSDS notebook where it is available to persons who could come in contact with hazardous chemicals.

D. Maintain a MSDS file with associated chemical permits for all hazardous chemicals used in the work area. **Note:** The MSDS and chemical permit are provided by the Chemical Crib for each new chemical when it is issued.

E. Ensure that MSDSs are kept in readily accessible locations so employees may refer to them any time they are in the work area. Provide a copy of a MSDS and chemical permit to an employee on request.

F. Ensure appropriate job-specific training is provided to employees who handle, use, or who could be exposed to hazardous chemicals within the work area. Supervisors will maintain a copy of job-specific hazard communication training records within the work area. See Section 8.0, Training, for additional training requirements. As new employees are trained or existing chemical workers leave, submit D-WK 504-8, HMMS Employee Update, to the supporting Chemical Crib.

G. Maintain a diagram showing the storage locations of hazardous chemicals in the work area, including those in pipes and equipment. Most chemicals are issued for immediate use (within 48 hours) and may not be stored in the workplace unless prior approval has been obtained.

H. Ensure hazardous chemicals are and remain properly labeled. If a label is damaged, a new one may be obtained by contacting the DFRC Chemical Crib in building 4823.

I. Each shop or work area will maintain written operation procedures for nonroutine tasks involving hazardous chemicals. These procedures will be made available to workers and be part of job-specific training.

5.4 Project/Program Managers

A. Identify hazardous materials and the necessary handling procedures that will be used during their project execution.

B. Ensure project, emergency response, and mishap investigation personnel are trained in proper handling procedures for identified chemicals.

C. Purchase required safe storage and use equipment and PPE to handle identified hazardous chemicals under normal, emergency, and mishap investigation responses.

D. Ensure non-DFRC project personnel who will be on site and are not handling hazardous chemicals receive basic hazardous chemical communication training.

5.5 DFRC Employees Not Handling Hazardous Chemicals

Even employees who do not handle hazardous chemicals need one-time basic hazardous communication training to be able to understand signs identifying hazardous chemical storage areas, to identify the hazards of chemicals being used in nearby areas, and to verify that any products they use are not hazardous.

5.6 DFRC Employees Handling Hazardous Chemicals

A. Will receive training on the proper handling of hazardous chemicals. If an employee feels he/she does not have adequate training to handle a chemical or chemicals, they will contact their supervisor and request additional training.

B. Will handle hazardous chemicals in accordance with MSDS and chemical permit instructions and workplace safety procedures.

5.7 Persons Who Requisition & Purchase Hazardous Chemicals

The purchase, storage, distribution, tracking, and disposing of hazardous materials and hazardous waste will be in accordance with instructions of DCP-S-102, Environmental Management System Chemical Management. For information on storage and handling of compressed and liquefied gasses, see DCP-S-065, Pressure Vessels & Pressurized Systems Safety.

5.8 Shipping & Receiving Personnel

A. Comply with requirements contained in DCP-S-102, Environmental Management System Chemical Management.

6.0 EMERGENCIES & NON-EMERGENCIES

DCP-S-054, Emergency Preparedness and Response, describes actions to be taken in case of chemical spills or exposures.

7.0 CONTRACTORS

A. On-site Contractors – On-site contractors will follow this procedure.

B. Off-site Contractors

1) Advise, with the assistance of the area supervisor, the off-site contractor of the hazardous materials they may encounter and protective measures needed in the normal course of their work.
2) Inform the off-site contractor that MSDSs and labels for hazardous chemicals used at DFRC may be obtained from the Chemical Crib.
3) Provide the Contracting Officer with a list of hazardous chemicals that will be used while the contractor is on-site. These hazardous chemicals will be approved by the SH&E Office SH before use. The contractor will also provide Code SH with MSDSs for all hazardous chemicals intended to be used.
4) Notify the off-site contractors that proof of hazard communication training for employees who will use or handle hazardous chemicals while completing work at DFRC may be required by the SH&E Office.

8.0 LABELS & WARNING SIGNS

A. Hazardous Chemicals Labeling Program

1) The SH&E Office Hazardous Waste Technician will oversee the hazardous chemicals labeling program.
2) DFRC will accept the labels provided by the manufacturer or wholesaler of hazardous chemicals when the labels are accurate and complete.

B. Warning Signs

Color-coded warning signs used to identify areas where hazardous chemicals are used and on storage facilities containing hazardous chemicals will comply with National Fire Protection Association 704, Chapter 6, Identification of Hazards of Materials for Emergency Response

9.0 NONROUTINE TASK

A nonroutine task is one that is included within a work area's normal activities but performed infrequently such as cleaning chemical tanks, changing chemicals, cleaning up spills, or temporary duties outside an individual's normal specialty.

A. Identified Nonroutine Task

1) Prior to starting work on a hazardous nonroutine task, every affected employee will be given information, by the supervisor in charge of the task, about the hazardous materials to which they may be exposed. Each nonroutine task will have a written procedure that is available to employees.

2) In order to become refamiliarized with nonroutine procedures, the person(s) conducting the nonroutine task will read and become familiar with the written procedures prior to the task being accomplished.

10.0 FACILITY HAZARD COMMUNICATION PLAN

Work places where employees are exposed to hazardous chemicals will have a written plan that describes how this document will be implemented. The plan will include the following:

A. Must list the chemicals used in the work area.

B. Indicate who is responsible for the various program aspects in your facility and the phone number at which they may be reached.

C. Indicate where printed materials are located and available to employees. (MSDS, DFRC Safety Manual, inventory, training records, annual audit reports, etc.)

D. A diagram showing the storage location of hazardous chemicals in the work place, location of fume hoods or portable exhaust systems, and location of PPE.

E. Small spill cleanup procedures and requirements.

Work area Hazard Communication Plan:

A. Appendix A contains an example of a site-specific HCP.

B. The plan must be posted in a conspicuous location.

C. All employees must know the location of the plan.

11.0 TRAINING

11.1 Safety, Health, & Environmental Office

The SH&E Office will provide basic hazard communication training to DFRC personnel on an as needed basis. This training is required by 29 CFR 1910.1200 (h); Employee Information and Training. Training will follow the guidelines of the CFR.

11.2 Directorates & Single Letter Organizations

Directorates and single letter organizations will ensure that, where hazardous chemicals are used in their areas of responsibility, supervisors and workers receive appropriate hazard communication training. New employees or employees transferred to a hazardous chemicals use area will receive training before being allowed to handle hazardous chemicals or work in the area.

11.3 Supervisors

Supervisors will ensure that workers under their supervision receive basic and job-specific hazard communication training prior to using or being exposed to hazardous chemicals. Basic training will usually be conducted by SH&E Office personnel but may be taught by persons qualified to teach the program such as qualified supervisors, occupational health personnel, and qualified off-site contract instructors. Refresher courses are not required for basic hazard communication training; however, supervisors are responsible to provide supplemental site-specific training for work with new chemicals or new processes. Employees who transfer to a new position or company may use their basic training certificate or SATERN training record as proof of training. Instructors who provide work area specific training, (usually a person from within the work area) will have their lesson plan reviewed by the DFRC Industrial Hygienist for technical accuracy.

12.0 MANAGEMENT RECORDS & RECORD RETENTION

Records pertaining to the DFRC HCP, including mishaps, close calls, hazard reports, and training records, will be maintained in accordance with NPD 1440.6, NASA Records Management. These records may be used to establish metrics and trend analysis. On-site contract managers will ensure that training records are maintained for their employees. Hazard Communication training records will be maintained in accordance with NPD 1441.1, Records Retention Schedules, and DFRC records management procedures. Destruction of any records, regardless of format, without an approved schedule is a violation of Federal law.

13.0 RELEVANT DOCUMENTS

13.1 Authority Documents

29 CFR 1910.1200 Hazard Communication.

NPD 8700.1	NASA Policy for Safety and Mission Success
NPR 8715.3	NASA Safety Manual

13.2 Referenced Documents

29 CFR 1910	Subpart Z, Toxic and Hazardous Substances
DCP-S-054	Emergency Preparedness & Response
DCP-S-065	Pressure Vessels and Pressurized Systems Safety
DCP-S-102	Environmental Management System Chemical Management
Disposal Act	As amended by the Resource Conservation and Recovery Act of 1976
National Fire Protection Association 704	Chapter 6
NPD 1440.6	Records Management

13.3 Information Documents

ANSI Z400.1	Hazardous Industrial Chemicals Material Safety Data Sheets
CAL/OSHA Title 8, Chapter 3.2, Article 5	Hazardous Substances Information and Training
29 CFR 1910.120	Hazardous Waste Operation and Emergency Response
NPD 1800.2	NASA Occupational Health Program
NPD 8710.2	NASA Safety and Health Program Policy

14.0 ACRONYMS

14.1 Acronyms

HCP	Hazard Communication Program
HMMS	Hazardous Material Management System
MSDS	Material Safety Data Sheet.

APPENDIX A – MATERIAL SAFETY DATA SHEET (MSDS) INSTRUCTION GUIDE & DEFINITIONS

GENERAL INFORMATION

It is estimated that there are currently over 600,000 chemical products used in the Unites States with new ones being introduced annually. Over 30 million workers are exposed to one or more of these chemicals. Thousands of workers sustain injuries each year in the United States as a result of improper handling of hazardous chemicals. Such injuries can cause pain and suffering, loss of income, change the quality of life, and shorten the life of individuals involved by causing health hazards such as heart ailment, kidney and lung damage, sterility, cancer, burns, and rashes. Chemicals may also pose physical hazards such as explosions, fires, chemical burns, or other serious accidents.

Because of the seriousness of health and safety problems these hazardous chemicals can cause, the Occupational Safety and Health Administration (OSHA), in an attempt to reduce injuries, has established a standard that employers must comply. The standard is 29 CFR 1910.1200, Hazard Communication.

The major requirement of the standard is to cause every employer to make employees aware of the standard, train employees in the safe handling of chemicals in the workplace, and make MSDSs available to anyone who works with or could come into contact with a hazardous chemical in the workplace.

The purpose of the MSDS is to inform the user of hazardous materials of the specific hazards the materials pose and how to safely use the materials to avoid those hazards both in normal usage and in emergency conditions. MSDSs are documents that could save you or your coworker from serious injury or even save a life.

You should not handle any known or suspected hazardous material until you study the MSDS. MSDSs should be reviewed periodically to ensure that proper procedures are being followed and to stay current with changes.

HAZARDOUS MATERIALS

Hazardous materials are those that are:

- Listed in 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances.
- Chemical or compound assigned a Threshold Limit Value (TLV®) by the American Conference of Government Industrial Hygienists (ACGIH) or a Permissible Exposure Limit (PEL) by OSHA.

- Chemicals or compounds determined to be carcinogen, corrosive, toxic, an irritant, a sensitizer, or can damage specific body organs.

MSDS FORMAT

There is no set format for MSDSs. They must, however, contain certain information and be written in English. OSHA has developed a recommended MSDS format, which is used in this attachment to show the information required by law.

MSDSs vary widely in quality. Even the ones that appear to be complete may miss important information. Always read the MSDS with caution. Should you have any questions regarding any portion of the MSDS ask you supervisor for assistance or contact the Safety, Health, and Environmental Office.

MSDS INFORMATION

As stated, there is no required format of MSDSs. You must find the section that contains the information you need. OSHA recommends the MSDS format used here.

Section 1: General Information

This section should contain the name, address, and telephone number of the manufacture or supplier of the chemical. There should also be a date of the MSDS given and the name, and trade name, if any, of the chemical and be exactly the same as on the label on the container. This section may also contain the formula of the chemical, DOT hazard class, and other general information that the manufacture or supplier wants to convey. Some companies use a heading to identify the material then use Section 1 to cover other information.

Importance – Section 1 is important because it allows the user or receiver of the chemical to quickly identify the chemical as the correct one. If there is a difference between the names on the MSDS and container label the chemical should not be accepted. The emergency telephone number allows the user to obtain added information especially in case of an emergency such as a spill or fire.

Section 2: Hazardous Ingredients Information

This section should list each hazardous chemical in the product and give their percentage of concentration (in some cases the percentage is optional). If exposure limits have been determined they will be listed for each chemical. You may find exposure limits listed as PEL, TLV®, TWA, LD50, or LC50, etc. These terms are explained in the dictionary portion of this attachment.

Trade Secrets – A manufacture does not have to release the names of the ingredients in a compound if the formula is declared a trade secret. However, in

the case of an emergency the manufacture is required by law to make the ingredients know to medical personnel.

Importance: Section 1 is important because it allows the user to know what the ingredients of a compound are, what hazards they pose, and what their exposure limits are.

Section 3: Physical/Chemical Characteristics

The physical/chemical characteristics section includes boiling point, specific gravity, vapor pressure, melting point, vapor density, evaporation rate, solubility, and appearance and odor, and other data the manufacturer wants to convey.

Importance – This section alerts the user to how a chemical will react in certain situations. By knowing the physical characteristics the user can better understand the hazards the chemical poses.

Section 4: Fire and Explosion Hazard Data

This section lists the flash point, flammable limits; LEL and UEL, extinguishing media, any special fire fighting procedures to include the use of protective clothing and respiratory equipment that is needed.

Importance – A quick review of this section informs the user about the potential fire and explosion precautions that are needed when using the chemical. It is also important to anyone who tries to control a fire or spill. When exposed to some volatile chemical, persons must leave the area and allow fire fighters or spill response personnel to attend to the emergency. This section will tell the user what action is recommended.

Section 5: Reactivity Data

If the chemical will react with certain materials it will be listed in this section. You may see considerable variation from one MSDS to another here, read the section with caution and if you have questions contact an Industrial Hygienist at the Safety Office. This section should cover situations that are most likely to happen if the chemical is not handled properly.

Importance – The information in this section will preclude accidental mixing of certain chemicals that cause undesirable reactions. It also alerts to the need to store reactivity chemicals away from each other. An example would be storing oxygen near any carbon-based material such as oils, grease, gasoline, etc. Should these materials mix there would be a hypergolic reaction resulting in fire or explosion. The type of storage container needed may be listed such as to store certain chemicals in explosion proof cabinets or on wood or metal shelves, etc.

Section 6: Health Hazard Data

A person may get a harmful chemical on board (in the body) by several routes. Entry into the body may be by eye or skin contact, inhalation, and ingestion. This section must describe all of the routes of entry pertinent to the material. Known acute and chronic health effects must be stated. Medical and first aid treatments for overexposure will be described.

Importance – Injury and even death from exposure to certain chemicals can be prevented if persons are aware of potential hazards. If an accidental exposure does occur the initial proper first aid or medical treatment can greatly reduce injury to the victim.

Section 7: Precautions for Safe Handling and Use

In this section the safe practices to follow in the event of an accident such as spills, leaks and disposal of wastes and other precautions are covered.

Importance – This section informs the workers on the safe procedures to take in case of a spill or release. This information will enable workers to preplan for an emergency and become trained in clean-up procedures. Federal, state, and local hazardous waste laws will govern the actions that should be taken during certain clean-ups. Never make a bad situation worse by reacting to a spill or release without the proper knowledge of how to accomplish the clean-up task.

Section 8: Control Measures

Proper procedures and the use of personal protection equipment (PPE) are covered in this section. This information will reduce the user exposure to a chemical. Respiratory protection, ventilation; local, general or special exhaust, protective gloves, eye protection, and other protective clothing or equipment required will be listed. Recommendations for work and hygiene practices may also appear here.

Importance – When a person is working directly with a hazardous chemical this section should inform them of the special procedures and PPE required to reduce exposure. In some MSDSs this section is weak. Example: the MSDS may state that respiratory protection is necessary but not state the type or level of equipment. When this is found contact an Industrial Hygienist at the Safety Office for clarification.

Section 9: Special Precautions and Comments

This section contains procedures for transporting chemicals and safe storage. The types of labels or markings on the container are covered and if required the DOT policies for shipping the chemical will be listed. Any other comments that the supplier wants the user to know may be given here.

Importance – How a material is moved and stored is important. A stored material is not necessarily safe. Containers can corrode and leak. Storing incompatible materials together can be very dangerous. This section may also have information that does not fit in other sections or a particular hazard may be reemphasized here.

MSDS DEFINITIONS

Absolute	A chemical substance that is not mixed, i.e., pure.
Absorption	To take in, for example, to absorb a chemical through the skin.
Acid	Any chemical that undergoes dissociation in water with the formation of hydrogen. Has a pH of less than 7.0. Neutralizes bases.
Acidosis	A condition of decreased alkalinity of the blood. Causes a sickly sweet breath, headache, nausea, vomiting, and visual disturbances. Usually a result of excessive acid production in the body. Body production of acid may be the result of contact with a chemical or drug.
Action Level	The concentration of a material in air at which level OSHA regulations take effect to protect employees.
Acute	Effects that generally occur rapidly as a result of short-term exposure and are of short duration. Effects may be listed as Acute Health Effects, Acute Toxicity, etc.
ACGIH	American Conference of Governmental Industrial Hygienists. This organization develops and publishes recommended occupational exposure limits for chemical substances and physical hazards. ACGIH recommended exposure limits are listed as Threshold Limit Values (TLV®).
Adsorption	The condensation and adhesion of a liquid on the surface of a solid such as moisture adhering to glass.
Aerosol	A fine aerial suspension with small enough particles to remain suspended in air.
Agent	Any substance, force, radiation, organism, or influence that affects

	the body, may be good or bad.
ALARA	As Low As Reasonably Achievable.
Air Line Respirator	A respirator that is connected to a compressed breathing air source by a hose.
Air Purifying Respirator	A respirator that uses chemicals to remove specific gases and vapors from the air or that uses a mechanical filter to remove particulate matter. These units may only be used where sufficient oxygen is present and the contaminant level is below the concentration limits of the unit.
Alkali	A chemical group that forms soluble soaps with fatty acids. May be referred to as bases. Can cause burn to skin. Turns litmus paper blue and has a pH from 8 to 14.
Allergic Reaction	An abnormal physiological response to chemical or physical stimuli by a sensitive person.
Ambient	Surrounding conditions. Usually refers to normal conditions.
Analgesia	Loss of sensitivity to pain.
Anesthetic	A chemical or drug that causes a total or partial loss of neural sensation.
Anhydride	A compound or chemical where water has been removed.
Anhydrous	Without water.
Anorexia	Loss of appetite.
Anosmia	Loss of smell.
Anoxia	Without oxygen. A lack of oxygen in inspired air. Not to be confused with Hypoxia.
ANSI	American National Standards Institute. A private organization that identifies needs for industrial standards and coordinates the development of those standards.
Antidote	A remedy to relieve, prevent, or counteract the effects of a poison.
API	American Petroleum Institute. Develops safe operating procedures for the petroleum industry.
Apnea	A condition where breathing temporarily stops.
Aquatic Toxicity, (AQTX)	The adverse effects to marine life resulting from being exposed to toxic substances.
Aqueous (aq)	Water based solution or suspension, sometimes describes a gaseous compound dissolved in water.
Article	A manufactured item that releases small quantities, if any, of

	hazardous chemicals and does not pose a health hazard in normal use. Usually controlled under consumer laws.
Asbestosis	Chronic lung disease caused by inhaling airborne asbestos fibers.
Asphyxiant	A vapor or gas that can cause unconsciousness or death by replacing oxygen in breathing air, causing suffocation. A hazard of confined space entry.
ASTM	American Society for Testing and Materials. Publishes voluntary consensus standards for materials, products, systems, and services.
Asymptomatic	Neither causing nor exhibiting symptoms.
Ataxia	A loss of muscular coordination.
atm	Atmosphere. Usually used in measurements of atmospheric pressure, i.e., one atm. One atm is 760 mmHg (29.92 in Hg) or 14.7 PSI of pressure.
Atmosphere Supplying Respirator	Provides breathing air from a source independent of the surrounding atmosphere. Air line or self-contained breathing apparatus.
Atrophy	The diminution (wasting away) of tissue, organs, muscles, or entire body due to lack of use.
Auto-Ignition Temperature	The temperature of a solid that, when a liquid is introduced on it, causes the liquid to ignite spontaneously.
Base	See Alkali
Biodegradable	A material that breaks down into innocuous products by the action of living things or naturally.
Biological Exposure Indexes (BEI)	Numerical values based on procedures to determine the amount of a material absorbed into the human body by measuring it or its metabolic products in tissue, fluid, or exhaled air.
Body Burden	The total amount of toxic materials that a person accumulates in the body over a period of time.
Boiling Point	The temperature at which a liquid turns to vapor. Always listed at a pressure of one atmosphere (760 mmHg) unless otherwise stated.
BOM	Bureau of Mines of the U. S. Department of Interior.
Bonding	The interconnecting of two objects by means of a conductor (wire). The purpose is to equalize the electrical potential thus eliminating static electricity discharge when transferring flammable liquids between containers.
Bradycardia	A heartbeat (slow) of 60/bpm or less.

Bronchitis	Inflammation of the bronchial tubes in the lungs.
btu	British Thermal Unit. Heat required to raise the temperature of 1 lb. of water 1°F.
Buffer	A substance that reduces the change in hydrogen ion concentration (pH).
CAA	Clean Air Act. Public law PL 91-604, 40 CFR 50-80.
Calorie	A unit of heat. Heat required to raise 1 g. of water 1 degree C.
CAR	Carcinogenic effect.
Carcinogen	A material that has been found either to cause cancer in humans or to cause cancer in animals and therefore is considered capable of causing cancer in humans.
Carcinoma	Cancer of malignant tumor. Cancer is the second most common cause of death. Many cancers are associated with our life style and environment.
CAS Chemical Abstract Service	CAS identifies chemicals by number, eliminating the confusion over various manufacturers' names.
Catalyst	A substance that makes a chemical reacting faster or slower without being consumed.
Caustic	See Alkali
CC	Closed cup. Used to determine flash points.
Ceiling Limit (C)	The absolute concentration that should not be exceeded during any part of a working exposure (OSHA).
Celsius (centigrade)	Zero C = 32 F Fahrenheit = (C x 1.8) + 32 Celsius = (F -32) x 5/9
CERCLA	Comprehensive Environmental Response Compensation and Liability Act. PL 96-510, 40 CFR 300. Establishes the superfund, a trust fund to help pay for cleanup of sites where hazardous materials have been released.
CFC	Chlorofluorocarons. Used as solvents and fire suppressants, also ozone damaging chemicals (ODCs).
CFR	Code of Federal Regulations.
Chelating Agent	A compound that bonds with metal ions. Used to treat metal poisoning.
CHEMTREC	Chemical Transportation Emergency Center. Operates a 24-hr. toll free telephone number that can be used during chemical transportation emergencies. As of this publication, 1-800-424-9300.

Chloracne	An acne-like condition caused by contact of a chemical.
Chronic	Effects that generally occur as a result of long-term exposure and are of long duration as opposed to acute, when chemicals are involved may be listed as Chronic Health Effects or Chronic Toxicity.
CNS	Central Nervous System.
CO	Carbon Monoxide. A colorless, odorless, and very toxic gas usually produced from incomplete combustion.
Combustible (liquids)	Any liquid that has a flash point of 100 F (38 C) or higher but below 200 f. See 29 CFR 1910.106. Nonliquid materials are defined as Ordinary Combustibles.
Cornea	The clear, transparent portion of the eye.
Corrosive	When applied to the body, a chemical that causes destruction of tissue at site of contact.
CPCS	Consumer Products Safety Commission.
Cutaneous	Pertaining to the skin.
CVS	Cardiovascular effects.
CWA	Clean Water Act. PL 92-500, 40 CFR 100-140 and 400-470.
Cyanosis / Cyanotic	A purplish coloration of the skin and mucous membrane usually caused by lack of oxygen in the blood.
Dangerous Reactive Material	A material that can react by itself (polymerization) or with other materials to produce a hazardous condition.
Decomposition	Chemical breakdown into parts. This process can be dangerous and may be caused by heat, electrolysis, decay, or reaction with other chemicals.
Density	The relation of density (weight) of one material to another, usually to water.
Depressant	A substance that reduces a bodily function activity or instinctive desire such as appetite.
Dermatitis	Damage and inflammation of the skin.
Dilution Ventilation	Airflow designed to dilute contaminates to acceptable levels. See general ventilation.
DOT Department of Transportation	Regulates transportation of hazardous chemicals.
Dust	Solid particles suspended in air. May be produced by crushing, grinding, abrading, or blasting. Most are inhalation, fire, or explosion hazards.

Dyspnea	Difficulty in breathing; shortness of breath.
Dysuria	Difficult or painful urination.
Edema	Abnormal accumulation of fluid in the body tissue.
Electrolyte	As applied to the body; a nonmetallic substance that conducts an electric current in solution by movement of ions rather than electrons.
Embolism	Obstruction in a blood vessel, such as air, blood clot, fat, or other masses.
Embryo	Early stage of development of an organism. In humans, conception to second month.
Embryotoxin	A material harmful to the embryo but usually not to the mother.
Emetic	An agent that induced vomiting such as Ipecac.
Emphysema	An irreversible disease of the lung in which alveolar walls lose resiliency resulting in reduction of lung capacity.
Engineering Controls	Engineering controls systems reduce potential hazards by removing or controlling the workplace hazard, such as ventilation, isolation, enclosures, etc.
EPA	Environmental Protection Agency.
Epidemiology	The study of disease in a population and search for the cause.
Epiphora	Excessive flow of tears; may be caused by a chemical exposure.
Epistaxix	Nosebleed. Heavy nosebleeds can be life threatening.
Ergonomics	The study of human characteristics.
Evaporation Rate	A measure of the time required for a given amount of substance to evaporate compared to the time required for an equal amount of ether or butyl acetate to evaporate.
Exothermic Polymerization	A polymerization reaction that produces heat. See Hazardous Polymerization.
Explosive Limits	See flammable limits.
Explosive	A chemical that causes a sudden release of pressure, gas, and heat when subjected to shock, pressure, high temperature, or ignition.
Exposure	Coming into contact with a hazardous chemical by inhalation, ingestion, skin or eye contact, or absorption.
Extinguishing Media	Fire fighting substance to be used to control a material in the event of a fire.
Eye Protection	Safety glasses, chemical splash goggles, face shields, etc. used

when handling a HAZARDOUS CHEMICALS.

Fahrenheit	See Celsius.
Fiber	Mater with a high ration of length to diameter, i.e., asbestos, wool, cotton, and polymers. May become lodged in the lungs and cause **fibrosis**.
Fines	Finely crushed or powdered material or fibers.
Fire Diamond (NFPA)	The NFPA fire diamond is a system for communicating the level of four classes of hazard which are identified by color.

BLUE (Health Hazards**)**

0	Ordinary Combustible in fire
1	Slightly Hazardous
2	Hazardous
3	Extreme danger
4	Deadly

Red (Fire)

0	Will not burn
1	Will ignite if preheated
2	Will ignite if moderately heated
3	Will ignite at most ambient
4	Burns readily at ambient conditions

YELLOW (Reactivity)

0	Stable and will not react with $H_2 0$
1	Unstable if heated
2	Violent chemical change
3	Shock and heat may detonate
4	May detonate

WHITE (Special Hazards)

OXY	Oxidizer
ACID	Acid
Alkali	Alkali
COR	Corrosive
W	Use no water
Radiation Hazard	

Flash Point	The temperature at which a liquid will produce sufficient vapor to ignite near its surface and continue to burn.
Flammable Liquid	A liquid that has a flash point below 100 F (38 C).
Flash Back	Flames travel along the trail of vapor back to its source.
Flammable Limits	Range of gas or vapor concentrations (percent by volume) in air, which will burn or explode if an ignition source is present.
Flash Point	The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite. There are several means of doing this test each of which may give different results.
Fully Protective Clothing	Includes SCBA; Self-Contained Breathing Apparatus and SCAPE, Self-Contained Atmospheric Protection Ensemble.
Fume	An airborne dispersion consisting of minute solid particles produced by heating a solid (e.g., condensed metal particulates from welding).
Gastroenteritis	Inflammation of the stomach and intestines.
General Exhaust	A system for exhausting contaminates from a general work area.

Generic Name	The nonproprietary name for a material.
Grounding	Conduction of electrical charges to the ground. Also see bonding.
Hand Protection	Specific type of gloves or other hand protection required during handling of hazardous chemicals.
Hazardous Decomposition	A material that reacts with other material to produce a hazardous material, i.e., burning, welding, heated, etc.
Hazardous Material	In a broad sense, any chemical or compound capable of causing physical injury or effects on health to humans.
Hazardous Polymerization	Where small molecules combine to form larger molecules, which may give off large amounts of energy.
Hematopoietic System	The blood forming mechanism of the body.
Hematuria	Blood in the urine.
Hemolysis	Separation of hemoglobin from red blood corpuscles.
HEPA	High-Efficiency Particulate Air-purifying respirator equipment.
Hepatotoxin	A substance that damages the liver.
HMIS	Hazardous Materials Identification System. A system used to communicate degree of chemical hazards similar to the NFPA diamond.
Hydrophilic	Materials that absorbs water and may swell.
Hygroscopic	Absorbs available moisture.
Hyperbolic	Ignites easily by ignition source or self-igniting when exposed to an oxidizer.
Hypoxia	Reduced level of blood to body cells, especially to brain cells.
IARC	International Agency for Research on Cancer. One of the sources that OSHA uses to identify carcinogens.
IDLH	Immediately Dangerous to Life and Health is the maximum concentration from which a worker could escape without injury or irreversible health effects, or escape-impairing symptoms as a result of a 30 minute exposure.
Impervious	A material that does not allow another substance to pass through it.
Incompatible	Materials that may cause dangerous reactions from direct contact with another.
Ingestion	Taking in a substance into the body through the mouth.
Inhalation	Breathing in a substance such as gas, vapor, fume, mist, or dust.

Inhibitor	A material that added to another will prevent reactions, which are usually unwanted.
Ignition Temperature	Minimum temperature required to initiate or cause self-sustained combustion independent of an ignition source.
Inorganic	Substances that do not contain hydrocarbons.
Irritant	A material capable of causing inflammation of eyes, skin, or lungs given a sufficient concentration and time. It is generally reversible.
Ketosis	Accumulation of ketone bodies in body tissues and fluids due to a disturbed carbohydrate metabolism.
Kilogram (kg)	Metric weight of about 2.2 pounds.
Label	Any written, printed, or graphic sigh or symbol displayed on or affixed to containers of hazardous materials.
Lacrimation	Production of tears.
Landfill	A site where waste is sealed and buried under earth.
Latency Period	The time that elapses between exposure and the first sign of the resulting disease. It may be minutes to years.
LC50 – Lethal Concentration	The concentration of a chemical in air that will kill 50 percent of a group of test animals by inhalation.
LD50 – Lethal Dose	A single dose of a chemical that is expected to kill 50 percent of a group of test animals.
LDLo – Lethal Dose Low	The smallest amount of a solid or liquid substance reported to have caused the death of animals or humans.
Liter (L)	Liquid metric volume about the same as a US quart. (1.05 of a quart).
Lesions	A change, injury, or damage to tissue or organ.
LEL – Lower Explosion Limit	The smallest amount of gas or vapor in air that will ignite with an ignition source. Also see UEL or Upper Explosion Limit.
Leukemia	A cancer of the bone marrow that results in the unrestrained production of white blood cells.
Local Exhaust Ventilation	A system for capturing and exhausting contaminants from the point where the contaminants are produced.
m3	Cubic meter.
Malaise	A feeling of general discomfort, distress, or uneasiness.
Material Safety Data Sheet (MSDS)	Material Safety Data Sheet is a required information sheet that must accompany all hazardous chemicals. The MSDS provides a major component of the Hazard Communications standard.

Melting Point	The temperature at which a solid substance changes to a liquid.
mg/kg	Milligrams per kilogram.
mg/m3	Milligrams of contaminants per cubic meter of air.
Miscible	The extent to which liquids or gases can be mixed.
Mist	Suspended liquid droplets in the air. May be caused by splashing or atomizing a liquid.
mmHg	Millimeters of mercury. A measure of pressure.
mppcf	Million particles per cubic foot.
Mutagen (MUT)	A chemical capable of causing mutations or alterations of the genetic material in living cells, usually carcinogens.
Narcosis	A state of stupor, unconsciousness, or arrested activity produced by the influence of narcotics or other chemicals.
National Fire Protection Agency (NFPA)	Publishes recommended fire codes including “diamond” hazardous warning labels.
Necrosis	Localized death of tissue.
Neoplasm	A new or abnormal tissue growth that is uncontrollable and progressive.
Nephrotoxic	Nephro = kidneys. Toxic = poison. A substance that is poisonous to the kidneys.
Neuritis	Inflammation of the nerves.
NIOSH	National Institute of Occupational Safety and Health. Conducts health and safety research and advises OSHA. Does not usually carry a force of law.
NOEL – No Effect Level	Nonflammable. Also a DOT hazard class for nonflammable compressed gases.
NTP – (National Toxicology Program)	A federal organization that tests for toxic materials. It also develops toxicological profiles on toxic materials.
Nuisance Dust	An airborne particulate of inert materials that are not known to cause disease.
Nystagmus	Involuntary motion of the eyes. May be accompanied by dizziness or position disorientation such as vertigo.
Odor Threshold	The lowest concentration of a substance’s vapor, in air, that can be detected by smell.
Organic	A class of chemical compounds that contain carbon.

OSHA	Occupational Safety and Health Administration. Works to assure safe and healthful conditions for employees by setting and enforcing standards.
Oxidizer	A chemical that promotes combustion by yielding oxygen. Examples include $Cl0_3$, N_20_4, $N0_3$, etc.
PEL	Permissible Exposure Limits. PEL standards are listed in 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3.
Percent Volatile by Volume	The percentage of a liquid by volume that evaporates at 70 F.
Personal Hygiene	Measures taken to limit exposure by keeping work areas and body clean, such as washing hands, work clothes, and equipment to eliminate hazardous residue.
Personal Protective Equipment (PPE)	Clothing or equipment worn to isolate workers from direct contact with hazardous material.
pH	A logarithmic scale from 1 to 14, which measures the acidity or alkalinity of a substance. Neutral is 7.0. Above 7.0 is an alkaline below 7.0 is acidic.
Physical Hazard	A chemical or material that may combust, explode, or in other ways do physical damage to persons or property as opposed to a health hazard due to toxicity.
Polymerization	A molecular change of a material where two or more small molecules combine to form a larger molecule. When this occurs the chemical may become unstable and or produce heat.
ppb	Parts per billion.
ppm	Parts per million.
ppt	Parts per trillion.
Prostration	Exhaustion or incapacitation.
Pulmonary	Pertaining to the lungs. Pulmonary edema = fluid in the lungs.
Pyrophoric	A substance that will ignite when exposed to ambient air without a source of ignition. Example: Triethyl Borane (Used to start SR-71 engines).
Reactivity	A measure of the tendency of a substance to undergo chemical change. Energy is usually released with a chemical change.
Reducing Agent	A chemical that will combine with oxygen or lose electrons in a reaction.
REL	NIOSH Recommended Exposure Limit.

Reproductive Toxin	Any chemical that will interfere with the male or female reproduction function. May alter germ cells, cause loss of sexual drive, impotence, infertility, or sterility (also see Mutagen, and Teratogen).
Resource Conservation and Recovery Act (RCRA).	This Act is designed to control hazardous wastes. See 40 CFR 240-271.
Routes of Entry	The means by which a hazardous chemical can enter the body.
SCBA/SCBAF	Self-Contained Breathing Apparatus; Self-Contained Breathing Apparatus with Face shield.
Sensitizer	A material that over time will cause a person to react to its exposure such as to cause irritation to skin, allergic reactions, etc.
Silicosis	Disease of the lungs caused by breathing silica dust.
Solubility in Water	The percent of a substance that will dissolve in water at ambient temperature.
Solvent	Will dissolve another substance.
Specific Gravity	The weight of a liquid or solid as compared to water.
Stability	The ability of a substance to be stored without undergoing unwanted changes.
Suspected Carcinogen	A substance that can cause cancer in test animals and may have the potential to do the same in humans although there is no definitive evidence in humans.
Systemic Toxicity	Adverse effects of a toxic that spreads throughout the body. Also, systemic poisoning.
Synergy	The interaction of two or more substances that gives a greater reaction than either substance by itself.
Tachycardia	A rapid heartbeat above 100 bpm.
Tachypnea	Fast breathing (may be for no apparent reason). See hyperventilation.
Target Organ	A body organ that is targeted by a chemical. Example excessive alcohol may target to liver
TCLo	Toxic Concentration Low; the lowest concentrations of a substance in air to which humans or animals have been exposed over a given time, which will cause a toxic effect.
TDLo	Toxic Dose Low; the lowest dose introduced other than by inhalation over a given time that will cause a toxic effect in humans or animals.

Teratogen	A chemical that can cause a fetus to be malformed. Example: Thalidomide.
TLV®	Threshold Limit Value is a recommended exposure limit established by the American Conference of Governmental Industrial Hygienists. The ACGIH is a private scientific organization that does not set legal standards. NASA mandates the use of TLVs where they are more protective than OSHA's PELs.
TLV®-TWA	Threshold Limit Value-Time-Weighted Average is the average concentration over a conventional 8-hour workday to which it is believed that nearly all workers may be repeatedly exposed, day after day, for a working lifetime without adverse effect.
TLV®-STEL	Threshold Limit Value-Short-Term Exposure Limit is the concentration to which it is believed that workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, 3) dose-rate-dependent toxic effects, or 4) narcosis of sufficient degree to materially reduce work efficiency. It is a 15-minute time weighted exposure average exposure that should not be exceeded at any time during a workday, even if the 8-hour time weighted average for that day is within the TLV-TWA. The TLV-STEL is limited to no more than four exposures per eight hours with 60 minutes between exposures.
TLV®-Ceiling	Threshold Limit Value-Ceiling is the concentration that should not be exceeded during any part of the working exposure.
Toxic Substance	Any substance that can cause injury or is believed to be capable of causing injury or health problems to humans.
Trade Secret	Information on the chemicals in a substance or procedures that a company wants to keep confidential in order to maintain advantage over competitors.
TSCA	Toxic Substances Control Act. See 40 CFR 700-799.
Tinnitus	A ringing sound in the ear. May be caused by nerve damage.
UEL Upper Explosive Limit	An explosive substance will not ignite at a greater concentration than the UEL. See LEL for lower explosive limit.
Unstable	A chemical that tends to decompose or react on a manner that could cause a hazard. Reaction may be triggered by temperature, pressure, shock, or mixing with other chemicals.
Uremia	Retention of body fluids.
Vapor Density	The weight of a gas or vapor compared to the weight of air.
Vapor Pressure, (VP)	The pressure a liquid will produce in a closed container above its own fluid. Vapor pressure is usually measured in millimeters of

	mercury (mmHg) at a temperature of 68 F or 20 C.
Ventilation	Any movement of air that circulates fresh air (uncontaminated) to replace contaminated air.
Vermiculite	May be referred to as “cat litter.” Expanded mica used as absorbent for spill control and clean up.
Volatility	A measure of how quickly a substance forms a vapor at ordinary temperatures.
Vertigo	The loss of spatial sense of position that causes a feeling of dizziness or spinning in space.
Viscosity	The tendency of a fluid to resist internal flow without regard to its density.
Waste Disposal Methods	Proper disposal methods for contaminated materials, recovered liquids or solids, and their containers.
Water-Reactive	A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.
Z-Lists	OSHA’s toxic and Hazardous Substance Tables located in 29 CFR 910.1000. Materials found in these tables are considered to be hazardous and require special handling.

APPENDIX B – AREA-SPECIFIC HAZARD COMMUNICATION PLAN TEMPLATE

HAZARDOUS CHEMICALS IN USE WITHIN THIS WORK AREA (laboratory, hangar, shop, etc.)**.**

Chemicals in the Workplace

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

For issue or disposition or any other information regarding hazardous chemicals, contact Chem Crib at ext. 2339.

NOTE: An inventory of chemicals that are approved for use will be downloaded from HMMS at least annually by the appropriate supervisor of the work area and submitted to the Safety Office annually for review during Dryden Safety Days. This list will be updated as new chemicals are introduced into the work area. This placard will be posted in plain view within each autonomous work area where hazardous chemicals are utilized.

Your local Hazard Communication Representative is

_____

Diagram of the locations of the Material Safety Data Sheet (MSDS) folder, engineering controls (fume hoods, portable exhaust, etc), PPE, and chemical storage (where permitted) within this work area.

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This page is for informational purposes and does not have to be retained with the document.

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