

CHEMICAL HYGIENE PLAN

Building: J.M. Patterson Bldg. (083)

Room(s): 3216

Department: Fire Protection Engineering

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UM Policy on Occupational Exposure to Hazardous Chemicals in Laboratories

Approved by the President September 19, 1994

A. Purpose.

This is a statement of official University policy to establish the process for compliance with the Occupational Safety and Health Administration (OSHA) regulation "Occupational Exposure to Hazardous Chemicals in Laboratories."

B. Policy.

The University is dedicated to providing safe and healthful laboratory facilities for students and employees, and complying with federal and state occupational health and safety standards. Laboratory administrators, managers, faculty, staff and students all share responsibility for minimizing their exposure to hazardous chemical substances which, for purposes of this policy, shall be defined as chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The Chemical Hygiene Plan shall be implemented for all facilities at the University of Maryland, College Park, where hazardous chemicals are handled or used under all of the following conditions: (i) chemical manipulations are performed in containers designed to be easily and safely manipulated by one person; (ii) multiple chemical procedures or chemicals are used; and (iii) demonstrably effective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

The Chemical Hygiene Plan shall be reviewed and evaluated for its effectiveness at least annually, and updated as necessary.

C. Responsibilities.

1. Department of Environmental Safety shall:

- (a) Appoint a Chemical Hygiene Officer to develop and coordinate administration of the UM Chemical Hygiene Plan (CHP);
- (b) Prepare the CHP with annual review and revisions as needed;
- (c) Distribute the CHP to each affected department for each Laboratory Supervisor or Principal Investigator (LS/PI);
- (d) Provide consultation, worksite monitoring (sampling), advisory assistance and information concerning use of hazardous materials;
- (e) Investigate, document and report to the BACH Committee, significant chemical exposure or contamination incidents;

- (f) Collect and dispose of hazardous, radioactive and other regulated wastes;
 - (g) Direct periodic laboratory safety audits to determine regulatory compliance, and recommend action to correct conditions generating release of toxic chemicals;
 - (h) Provide training to all laboratory workers concerning:
 - (1) Provisions of the Chemical Hygiene Plan;
 - (2) Physical and health hazards of chemicals in the work area;
 - (3) Measures to protect employees from chemical hazards;
 - (4) Signs and symptoms associated with hazardous chemical exposure;
 - (5) Location of reference materials on the hazards, safe handling, storage and disposal of laboratory chemicals;
 - (6) The contents of the OSHA standard and its appendices;
 - (7) The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed; and
 - (8) The methods and observations used to detect the presence or release of a hazardous chemical.
2. Laboratory Supervisors/Principal Investigators (LS/PI) shall:
- (a) Implement all provisions of the Chemical Hygiene Plan for laboratory facilities under their control;
 - (b) Develop and maintain a customized Chemical Hygiene Plan for laboratory operations under their control to include:
 - (1) Alphabetized inventory of all hazardous chemical substances,
 - (2) Written Standard Operating Procedures to address safety and health issues associated with work practices, protective equipment, in laboratory facilities under their control;
 - (3) Identification of occurrences or operations that may be encountered by laboratory employees and that require that the LS/PI be advised (prior approval).
 - (c) Prepare and implement laboratory-specific Standard Operating Procedures (SOPs) to include work practices, protective equipment, engineering controls, emergency procedures and waste disposal procedures;
 - (d) Demarcate and indicate on SOP all areas designated for the use of particularly hazardous chemicals (i.e., select carcinogens, reproductive toxins and acute toxins);
 - (e) Train laboratory workers regarding the specific practices and provisions contained in the laboratory SOP;
 - (f) Ensure that all lab employees have access to Material Safety Data Sheets for hazardous chemicals that are purchased or otherwise acquired for use in the lab facility;
 - (g) Ensure that all necessary personal protective equipment is available and used by lab employees;
 - (h) Notify the designated UM contact points when any of the University of Maryland prior notification conditions are anticipated;
 - (i) Comply with necessary documentation requirements; and

- (j) Submit a current copy of their Chemical Hygiene Plan(s) including all required components to the Department of Environmental Safety and Departmental Compliance Officer.
- 3. Biological and Chemical Hygiene (BACH) Committee shall:
 - Review and approve all aspects of the Chemical Hygiene Plan and provide technical guidance for implementation of campus policy concerning chemical and biological safety.
- 4. University Health Center shall:
 - (a) Coordinate and direct all required or recommended medical surveillance programs;
 - (b) Provide medical consultations and examinations for laboratory workers who have been overexposed, or suspect overexposure, to hazardous chemical substances; and
 - (c) Maintain medical records relating to consultations, examinations and medical surveillance as required by law.
- 5. Departmental and College Compliance Officers shall:
 - (a) Assist Environmental Safety and laboratory supervisors with implementation of the Chemical Hygiene Program; and
 - (b) Maintain current copies of Chemical Hygiene Plans.
- 6. Department Chairs and College Deans shall:
 - (a) Require implementation of the Chemical Hygiene Program for affected laboratories under their control.
- 7. Individual Researchers and Laboratory Users shall:
 - (a) Adhere to the requirements of the Chemical Hygiene Plan and SOPs;
 - (b) Complete all safety training requirements and comply with documentation procedures;
 - (c) Notify the PI/LM if any prior notification situations or occurrences are anticipated; and
 - (d) Report all workplace injuries, chemical exposure incidents or unsafe conditions to their LS/PI as soon as possible.

D. Information

Assistance will be provided by the Department of Environmental Safety to any Department requesting guidance or training to satisfy implementation of this policy.

Emergency Telephone Numbers

UM Emergency (FIRE - POLICE - RESCUE) - 24 hour # 911

CALL IMMEDIATELY FOR ANY EMERGENCY INCLUDING
INJURED OR SICK PERSON, CHEMICAL SPILL OR FIRE

Environmental Safety (Main Office) (301) 405-3960
(Industrial Hygiene, Hazardous Waste Management,
Fire Protection, Hazard Communication, Safety
Education)

Chemical Hygiene Officer (301) 405-3980
(Program Consultation and Administration)

Biological Safety (301) 405-3960
(Biological Safety, Regulated Pathogen Consultation)

Radiation Safety (301) 405-3985
(Health Physics, Radioactive Materials Procurement)

University Health Center Occupational Health (301) 314-8172
(Medical Consultation and Evaluation)

Workers' Compensation Office (301) 405-5466

Facilities Management Work Control (301) 405-2222
(Repair of Facility Equipment Deficiencies, e.g.,
fume hoods, emergency eyewashes, ventilation, etc.)

| Laboratory Supervisor(s): | Business-hours # | After-hours # |
|---------------------------|------------------|---------------|
| Michael J. Gollner | 301.405.6667 | 951.756.6020 |
| Peter B. Sunderland | 301.405.3095 | 216-469-3858 |

| Laboratory Personnel: | Business-hours # | After-hours # |
|-----------------------|------------------|---------------|
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Standard Operating Procedures (SOPs)

A comprehensive health and safety program should include documents that provide descriptions of standard methods or operations used within the facility. They should describe in clear and precise language the means and methods to be used by laboratory workers to minimize the risk of hazardous exposure while using hazardous chemicals.

These documents, commonly referred to as standard operating procedures (SOPs), should be followed by all laboratory employees.

The LS/PI is responsible for preparation of lab-specific SOP documents for attachment to the CHP. The LS/PI is responsible for determining the adequacy of the SOPs prepared. The lab-specific SOPs shall be incorporated in the on-site copy of the Chemical Hygiene Plan and placed in a designated location within the laboratory for immediate access by employees.

A good SOP is one that is clearly stated and realistic in scope. A laboratory LS/PI should prepare SOPs for all routine and repetitive operations as well as for general laboratory operations. The format of all SOPs should be consistent and should incorporate:

1. Facility name, department and section affected by or using the procedure;
2. Subject;
3. Issue date of the original document or current revision;
4. Any indication that revisions replace an earlier procedure;
6. Signature or initials of the SOP preparer as well as any reviewing authority; and
7. Concise instructions for safe and healthful performance of laboratory activities and procedures.

SOPs should indicate the measures that will be used to reduce or prevent employee exposure to hazardous chemicals, including engineering controls, hygiene practices, and the use and maintenance of personal protective equipment.

SOPs should include provisions for additional employee protection for work with particularly hazardous substances, including select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity. (See "Identification of Hazardous Materials, below.) Where appropriate, these additional measures should include:

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes;

3. Procedures for safe removal of contaminated waste; and
4. Procedures for site and personal decontamination.

SOPs shall also indicate circumstances under which certain laboratory procedures, operations or activities require prior approval from the LS/PI before implementation (e.g., use of radioactive materials, bench top manipulation of volatile carcinogenic solvents without use of engineering controls, night or weekend work performed alone, reagent substitutions, etc.).

Examples of SOPs are available on the DES website at:

<http://www.des.umd.edu/ls/index.html>

Medical Consultation and Examinations

Employees who work with hazardous chemicals in the laboratory should be referred for medical consultation, examination, and/or surveillance (as appropriate to the circumstances) whenever:

1. An employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory;
2. An event takes place in the work area to create a likelihood of hazardous exposure; or
3. Exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements. (See "Exposure Monitoring" section, below.)

Examples of events or circumstances which might result in hazardous exposure include:

1. A spill or leak which rapidly releases a hazardous chemical in an uncontrolled manner;
2. Direct skin or eye contact with a hazardous chemical;
3. Symptoms such as headache, rash, nausea, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgement which disappear when the employee is removed from the exposure area and which reappear when the employee returns to working with the same hazardous chemical;
4. Two or more employees in the same laboratory work area exhibit similar symptoms; or
5. Exposure monitoring indicates exposures above regulated or recommended limits.

The University has established procedures for responding to job-related injuries. These procedures should be followed in the event of hazardous exposure due to the use of hazardous chemicals in the laboratory. Instructions and forms for reporting injuries and chemical exposures are available through the DES web page:

http://www.des.umd.edu/risk_comm/wcomp/

In the event of life-threatening injuries or illnesses, the UM Emergency Dispatcher should be immediately notified. All injury or illness occurring as a result of work activities should be reported to the Workers' Compensation Office, immediately after the incident occurs or the injury is treated. All incidents of hazardous exposure, including their disposition, should be reported to the Chemical Hygiene Officer.

The following information should be provided at the time that an employee is referred for medical consultation and/or examination:

1. Identity of the chemical(s) to which the employee may have been exposed;
2. Description of the conditions under which the exposure occurred, including any quantitative exposure data, if available; and

3. A description of the signs and symptoms of exposure that the employee experienced, if any.

A written report must be provided to the employer from any physician to whom the employee is referred for medical consultation or examination in connection with hazardous exposure. The physician's report(s) should indicate **ONLY** the specific findings of diagnoses related to occupational exposure and should include the following information:

1. Any recommendation for further medical follow-up;
2. The results of the medical examination and any associated test(s);
3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and
4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

As indicated above, all incidents of hazardous exposure (including disposition) should be reported to, and documented by, the Chemical Hygiene Officer (CHO). If no further assessment of the incident is deemed necessary, the reason for that decision should be included in the documentation. If the event is determined to require investigation, a formal exposure assessment will be initiated by the CHO. The purpose of an exposure assessment is not to determine whether there was a failure to follow proper procedures, but to identify the hazardous chemical(s) involved and determine whether an exposure might have caused harm to an employee. An exposure assessment may include the following items:

1. Interviews with the employee and complainant (if different);
2. Obtaining the following information:
 - the names of chemicals which may be involved
 - other chemicals used by the employee
 - all chemicals used by others in the immediate area
 - other chemicals stored in the immediate area
 - symptoms exhibited or claimed by the employee
 - comparison of symptoms with those referenced in the Material Safety Data Sheet for each involved chemical

- observation of control measures and personal protective equipment in use during the event
 - notation of any on-site exposure monitoring performed previous to or during event
3. Monitoring or sampling the air in the area for suspect chemicals; and
 4. Determination of whether the current control measures were adequate during the time of the incident.

Identification of Hazardous Materials

A hazardous chemical is defined by the OSHA laboratory standard as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes or mucous membranes.

Laboratory supervisors have certain responsibilities for the management of these hazardous chemicals, including:

1. Inventory of all hazardous chemical substances which are used in their laboratories, and attaching the inventory to this CHP;
2. Maintenance of the labels on incoming containers of hazardous chemicals to ensure that they are not removed or defaced;
3. Maintenance of any Material Safety Data Sheets (MSDSs) that are received with incoming shipments of hazardous chemicals, and ensuring that the MSDSs are readily accessible to laboratory employees; and
4. Determination of whether chemical substances which are developed in the laboratory are hazardous chemicals within the definition of this CHP. If the chemical substance is a byproduct for which the composition is unknown, the substance should be deemed to be a hazardous chemical.

Laboratory supervisors also are responsible for identifying the following hazardous chemicals which are required to be used in an area specially designated for such use:

1. Select carcinogens: Any substance which meets one of the following criteria:
 - it is regulated by OSHA as a carcinogen;
 - it is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (latest edition);
 - it is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer (IARC) Monographs (latest edition); or
 - it is listed in either Group 2A or 2B by the IARC, or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with criteria specified in the OSHA laboratory standard.

2. Reproductive toxins: Chemicals which affect the reproductive capabilities, including chemicals which are mutagenic and teratogenic;
3. Acute toxins; and
4. Unknowns: Chemicals which are synthesized in the laboratory and which are byproducts for which the composition is unknown.

Information concerning the health effects of chemical substances can be located in the following reference sources:

1. Material Safety Data Sheets (MSDS)

MSDSs are available through:

- (A) The Department of Environmental Safety (DES):
 1. Web Page (<http://www.des.umd.edu/>),
 2. Telephone (301-405-3960), or
 3. After normal hours through UM Emergency Dispatcher at 911), and
- (B) the vendor, manufacturer or distributor. (A MSDS must be provided at the time of initial purchase by the vendor, manufacturer or distributor without charge. A nominal fee may be assessed for additional copies.)

2. Registry of Toxic Effects of Chemical Substances (available through the DES Web Page: (<http://www.des.umd.edu/os/ccinfo/index.html>))
3. National Toxicology Program (Chemistry Library or DES)
4. International Agency for Research on Cancer (Chemistry Library or DES)
5. DES maintains an Internet database of the Select Carcinogens as well as chemical substances that may be considered acute and reproductive toxins. This list may be accessed at:
<http://www.des.umd.edu/ls>

Use of any of the following materials may be subject to specific occupational safety and health standards as shown:

| | |
|---|------------------|
| Asbestos, tremolite, anthophyllite and actinolite | 29 CFR 1910.1001 |
| 4-Nitrobiphenyl | .1003 |
| alpha-Naphthylamine | .1004 |
| 4,4'-Methylene bis(2-chloroaniline) | .1005 |
| Methyl chloromethyl ether | .1006 |
| 3,3'-Dichlorobenzidine (and salts) | .1007 |
| bis-Chloromethyl ether | .1008 |
| beta-Naphthylamine | .1009 |
| Benzidine | .1010 |

| | |
|---|-------|
| 4-Aminodiphenyl | .1011 |
| Ethyleneimine | .1012 |
| beta-Propiolactone | .1013 |
| 2-Acetylaminofluorene | .1014 |
| 4-Dimethylaminoazobenzene | .1015 |
| N-Nitrosodimethylamine | .1016 |
| Vinyl Chloride | .1017 |
| Arsenic (inorganic) | .1018 |
| Lead | .1025 |
| Cadmium | .1027 |
| Benzene | .1028 |
| Cotton dust | .1043 |
| 1,2-Dibromo-3-chloropropane | .1044 |
| Acrylonitrile | .1045 |
| Ethylene oxide | .1047 |
| Formaldehyde | .1048 |
| 4,4'-Methylenedianiline | .1050 |
| Methylene Chloride | .1052 |
| Non-Asbestiform tremolite, anthophyllite and actinolite | .1101 |

These standards are not replaced by the Occupational Exposure to Hazardous Chemicals in Laboratories standard. Users of these materials are expected to adhere to the provisions of all applicable substance-specific standards if employee exposure routinely exceeds the OSHA-mandated permissible exposure limit (or Action Level, if specified). Copies of these standards may be obtained from the Department of Environmental Safety or through the OSHA website at:

www.osha.gov

Information and Training

All UM employees must assume an active role in maintaining a safe working environment by reporting any problems or noncompliance with policies to the LS/PI. All employees should fully utilize any information provided during formal and informal training sessions. Any staff member who does not understand a policy or procedure should consult the LS/PI, departmental safety committee or DES for clarification.

All employees shall be provided with information and training regarding the hazards of the chemicals in their work area. Employees shall be informed of:

1. The contents of the OSHA standard and its appendices;
2. The location and availability of the CHP;
3. The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed;
4. The methods and observations used to detect the presence or release of a hazardous chemical;
5. The physical and health hazards of chemicals in the work area;
6. The measures employees can take to protect themselves from chemical hazards, including specific procedures (SOPs) to be used;
7. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
8. The location of known reference material on the hazards, safe handling, storage, and disposal of chemicals found in the laboratory.

Distribution of training materials to LS/PIs and members of departmental safety committees is coordinated through the Department of Environmental Safety. Training of laboratory workers in general laboratory safety and the provisions of the OSHA laboratory standard's requirements shall be conducted by UM Chemical Hygiene Officer (or designee) during training sessions scheduled through the Department of Environmental Safety or through special arrangement with DES. An on-line Chemical Hygiene training course is also available to UM laboratory employees at the following website:

<https://des.umd.edu/TrainingClass/index.cfm>

The LS/PI shall be responsible for training of all supervised laboratory employees as to specific operations, safety equipment, emergency procedures, SOPs and chemical use which apply to the laboratory facilities. Documentation of general laboratory safety and CHP training conducted by the Department of Environmental Safety shall be maintained within each department and by the Department of Personnel Services as part of the employee's permanent record. Documentation of laboratory-specific training provided by the LS/PI shall be maintained within each department and laboratory.

Exposure Monitoring

OSHA has established "Permissible Exposure Limits" (PELs) for laboratory employees' exposures to certain regulated substances. Exposure levels must be determined and monitored under certain circumstances. A medical surveillance program has been established for certain specified employees whose work assignments involve regular and frequent handling of toxicologically significant quantities of a chemical. In addition, the Department of Environmental Safety is responsible for making determinations regarding the requirements for area and/or personal exposure monitoring in specific circumstances.

PELs are specified in the OSHA regulation 29 CFR 1910, Subpart Z Toxic and Hazardous Substances. In addition, PELs are usually indicated on the MSDSs, and can be obtained from the Department of Environmental Safety.

These limits are defined as:

- Eight-hour time weighted average (TWA)
The average concentration to which an employee may be exposed to a particular chemical for up to eight hours per day, five days per week.
- Short Term Exposure Limit (STEL)
The average concentration to which an employee may be exposed to a particular chemical for up to fifteen minutes per day.
- Ceiling (C)
The maximum concentration to which an employee may be exposed to a particular chemical at any time.

Often, a notation of "Skin" is printed with an exposure limit. This indicates that skin absorption of that chemical occurs readily which would contribute to an employee's overall exposure. Employee exposure to dermal absorption of chemical substances can often be monitored through the use of biological testing.

Employee exposure should be monitored in the following circumstances:

1. Initially, where there is reason to believe that exposure levels to any chemical substance regulated by a standard routinely exceed the action level (or in the absence of an action level, the PEL) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements; and
2. Periodically, where the initial monitoring discloses employee exposure over the action level (or in absence of an action level, the PEL).

The general training provided by the Department of Environmental Safety will include information regarding the identification of situations where employee exposure might exceed the PEL, TLV or STEL. TLVs (Threshold Limit Values) are eight-hour time-weighted average inhalation exposure limits recommended by the American Conference of Governmental Industrial Hygienists. The Department of Environmental Safety will perform area and/or personal exposure monitoring at the request of any LS/PI or laboratory worker. The employee will be provided written notification of monitoring results, within 15 working days after receipt of monitoring results by the University.

Where initial monitoring discloses employee exposure over the action level (or in the absence of an action level, the PEL), the affected employee must be provided with personal protective equipment, unless engineering controls are available as a feasible means of controlling exposure. The LS/PI is responsible for ensuring that appropriate protective equipment is available to laboratory employees.

Monitoring will be terminated when appropriate in accordance with the relevant standard.

Prior Approvals

The Principal Investigators/Laboratory Supervisors (LS/PI) is responsible for providing institutional notifications as defined below:

1. Any purchase, possession or use of explosive materials (as defined by the US Department of Alcohol, Tobacco & Firearms) must be approved by the UM Fire Marshal (301-405-3970). A comprehensive list of explosive materials may be accessed from the ATF Website at:
http://www.atf.treas.gov/pub/fire-explo_pub/listofexp.htm
2. Any modification to a chemical fume hood or other laboratory local exhaust system must be reviewed and approved by the Department of Facilities Management (301-405-0255) and/or the Department of Environmental Safety (405-3960) before it may be used as a means to control exposure to hazardous materials.
3. Any use of hazardous chemicals that may present a hazardous condition due to inadequate ventilation must be reviewed and approved by the Chemical Hygiene Officer prior to initiation of the operation.
4. Any research involving animals must be reviewed and approved by the Institutional Animal Care and Use Committee. Additional information is available at the following Website:
<http://www.umresearch.umd.edu/IACUC/>
5. Any possession or use of radioactive materials or radiation-producing devices must be reviewed and approved by the Radiation Safety Officer. Additional information may be obtained by calling (301) 405-3985.
6. Any research work involving human subjects must be reviewed and approved by the Institutional Review Board. Additional information is available at the following Website:
www.umresearch.umd.edu/IRB
7. Any purchase, possession or use of etiologic agents must be reviewed and approved by the UM Biosafety Officer. Additional information may be obtained by calling (301) 405-3975 or from the following website:
<http://www.des.umd.edu/biosafety/infectious/index.html>
8. Treatment (e.g., neutralization) or drain disposal of any hazardous waste must be reviewed and approved by the Environmental Affairs section of the Department of Environmental Safety. Additional information may be obtained by calling (301) 405-3163.

9. Any use of respirators must be reviewed and approved by the UM Respiratory Protection Program Administrator. Additional information may be obtained by calling (301) 405-3980 or from the following website:
<http://www.des.umd.edu/os/respirator/index.html>

10. The use of extremely toxic gases must be reviewed and approved by the Chemical Hygiene Officer prior to initiation of work. These gases include:
 - Arsine and gaseous derivatives
 - Chloropicrin in gas mixtures
 - Cyanogen chloride
 - Cyanogen
 - Diborane
 - Germane
 - Hexaethyltetraphosphate
 - Hydrogen cyanide
 - Hydrogen selenide
 - Nitric oxide
 - Nitrogen dioxide
 - Nitrogen Tetroxide
 - Phosgene
 - Phosphine

Laboratory employees are responsible for obtaining approval from the LS/PI if any of the following operations will occur:

1. Laboratory operations that will be left unattended.
2. Modification of any established laboratory procedure.
3. Modification to laboratory chemical inventory.
4. Continuation of any laboratory procedure if unexpected results occur.
5. Use of Particularly Hazardous Materials in locations where no engineering controls (e.g., fume hood) are to be used.
6. Any operation for which employees are not aware of the hazards nor are confident in their ability to be adequately protected.

The LS/PI is also required to evaluate these specific laboratory operations and include in Appendix II any additional conditions that require prior approval.

Laboratory Safety Guide and References

The Laboratory Safety Guide is a separate document prepared and distributed by the Department of Environmental Safety which is available on-line at:

<http://www.des.umd.edu/lis/index.html>

The Guide was assembled to assist laboratory supervisors and workers in their daily operations at UM and to provide a means to lessen employee exposure to hazardous materials and operations. It can supply much of the information needed to provide laboratory workers a safe working environment. However, laboratory workers should not assume that this guide will supply sufficient information to prevent injury and protect the environment. The nature of the work that is performed in many research and testing laboratories increases the necessity for safety planning and awareness. The Principal Investigator and other faculty often have special expertise in the unique or specific experimental processes used in laboratories under their control, and the prepared SOP may supersede general laboratory safety guidelines.

Recommended reference sources concerning safe operations in laboratories include:

CRC Handbook of Laboratory Safety

CRC Press, Inc.

Guide for Safety in the Chemical Laboratory

Van Nostrand Reinhold Company

Improving Safety in the Chemical Laboratory

John Wiley and Sons

Prudent Practices for Handling Hazardous Chemicals in Laboratories

National Academy Press

Safe Storage of Laboratory Chemicals

John Wiley and Sons

Safety in Academic Chemistry Laboratories

American Chemical Society

Appendix I

X-7.00(A) UM POLICY CONCERNING FIRE EMERGENCIES APPROVED BY THE PRESIDENT MARCH 6, 1993

- A. Purpose. This is a statement of official University policy for the reporting of fire emergencies and for the evacuation of campus buildings during fire emergencies, in compliance with local, state, and federal regulations.
- B. Policy. A fire emergency exists whenever:
1. A building fire evacuation alarm is sounding;
 2. An uncontrolled fire or imminent fire hazard occurs in any building or area of the campus;
 3. There is the presence of smoke, or the odor of burning;
 4. There is spontaneous or abnormal heating of any material, an uncontrolled release of combustible or toxic gas or other material, or a flammable liquid spill.
- C. Procedures. Campus Buildings shall be immediately and totally evacuated whenever the building evacuation alarm is sounding.
1. Upon discovery of evidence that a fire emergency exists, an individual shall accomplish, or cause to be accomplished, the following actions:
 - (a) **SOUND AN ALARM.** Activate the building fire alarm in buildings equipped with a manual fire alarm system. Shout a warning and knock on doors as you evacuate in buildings not equipped with a fire alarm.
 - (b) **SHUT OFF ALL MACHINERY AND EQUIPMENT IN YOUR AREA.**
 - (c) **LEAVE THE BUILDING AT ONCE.**
 - (d) **CALL THE FIRE DEPARTMENT FROM A SAFE PLACE.**
 - (1) On-Campus phones DIAL 911
 - (2) Off-Campus phones and campus pay phones DIAL 911
 - (3) Use Campus emergency phones;
Indoors - Yellow wall phones with red "EMERGENCY" markings (some corridors)
Outdoors - Yellow phone boxes with red "EMERGENCY" markings, under blue lights.
 - (4) When the emergency operator answers, ask for the fire department, give as much specific information as possible. State that you are from UMCP and include the proper name of the building and room number, floor, or other specific area. Do not hang up until released by the dispatcher. **A PHONE CALL MUST BE MADE! ALL BUILDING FIRE ALARMS DO NOT NOTIFY THE FIRE DEPARTMENT.**
 - (e) **MEET THE FIRE DEPARTMENT OUTSIDE AND DIRECT THEM TO THE EMERGENCY.**
 - (f) **ALL FIRES, EVEN IF EXTINGUISHED OR FOUND EXTINGUISHED, MUST BE REPORTED.**
 - (g) **ALL FIRE ALARMS, EVEN IF SUSPECTED TO BE FALSE OR ACCIDENTAL, MUST BE REPORTED TO THE FIRE DEPARTMENT.**
 2. The evacuation procedures shall be as follows:
 - (a) It shall be the responsibility of every person to immediately leave a University building whenever the fire alarm is activated or a fire emergency exists. All students, faculty, and staff are required to leave the building and remain outside until the emergency is over. No one shall restrict or impede the evacuation.

- (b) Department heads are expected to review annually fire prevention and fire survival information with faculty and staff, or to schedule such a presentation with the Department of Environmental Safety. Such information is available from the Department for use and distribution.
3. Whenever it is brought to the attention of the staff of residential buildings, or departmental personnel, that the fire alarm or sprinkler system is inoperable or has been placed out of service, a firewatch shall be established.
- (a) Responsible personnel (residential staff, safety committee, etc.) shall be assigned to the firewatch.
 - (b) The entire building shall be toured at least one time during each hour of the firewatch.
 - (c) The emergency dispatcher (405-3555) shall be notified each hour that the watch has been performed.
 - (d) The firewatch shall be maintained at all times that the building is occupied until the fire protection system is repaired.
4. **INTERRUPTION OF FIRE ALARM:**
- (a) No person may shut off any fire protection or alarm system during a fire emergency incident without the permission of the fire department officer in charge.
 - (b) No person may shut off any fire protection or alarm system during a bomb threat emergency without the permission of the police officer in charge.
 - (c) It shall be the responsibility of the Department of Facilities Management Department to reset or repair any fire protection or alarm system after an emergency incident when notified by the fire or police department in charge. The Department of Facilities Management shall inspect each such system immediately after every emergency incident and place the system in serviceable condition.
 - (d) The fire and police departments may reset an alarm system only if there is no damage to the system and when it is within their technical capabilities to do so.
 - (e) Any person desiring to interrupt service to any fire protection or alarm system must obtain permission from the Department of Facilities Management, Work Control Center (405-2222) which shall notify the fire and police departments of every such interruption.
 - (f) Fire or police department must request the Facilities Management to repair or rest a fire protection system, via the Work Control Center (405-2222).
5. **INFORMATION RELEASE TO MEDIA AND THE PUBLIC:**
All information regarding University fires will be released through the Department of Environmental Safety in cooperation with the Public Information Office. No other University agency or employee may release official statements regarding the cause, origin, or nature of campus fires.

D. Information

Assistance will be provided by the Department of Environmental Safety to any Department requiring help and advice in its implementation of this UM policy.

Appendix II

Prior Approval Criteria

The LS/PI shall indicate any circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the LS/PI (or designee) before implementation. If no circumstances are identified, the LS/PI shall write "none" in the first provided space. Additional pages may be added as determined necessary by the LS/PI.

1. Circumstance: _____

Prior approval to be obtained from: _____

2. Circumstance: _____

Prior approval to be obtained from: _____

3. Circumstance: _____

Prior approval to be obtained from: _____

4. Circumstance: _____

Prior approval to be obtained from: _____

5. Circumstance: _____

Prior approval to be obtained from: _____

6. Circumstance: _____

Prior approval to be obtained from: _____

7. Circumstance: _____

Prior approval to be obtained from: _____

Appendix III

Standard Operating Procedures

(to be attached by Laboratory Supervisor)

Standard Operating Procedure # 1

General Laboratory Safety

Facility: New Laboratory

3216 J.M. Patterson Building

Department of Fire Protection Engineering

Lab Director: Dr. Michael J. Gollner

3104A J.M. Patterson Building

301-405- 6667

Scope: This SOP details general laboratory safety procedures to be followed in the Koffel Laboratory.

Last Revision: December 10, 2012

General:

This procedure addresses general safety & health requirements for work in the laboratory.

Procedures:

I. HAZARD IDENTIFICATION

A. All chemical containers must have a legible, firmly attached label showing the contents of the container.

B. Labels on incoming containers of hazardous chemicals must not be removed or defaced. Any labels that are damaged must be immediately replaced with labels containing the same identification, warning and source information.

C. Material safety data sheets (MSDS) received with incoming shipments of hazardous chemicals must be maintained and made readily accessible to laboratory employees.

D. A hazard review of new materials not previously used in the laboratory must be completed under direction of the LS/PI before actual handling of the material begins.

E. Chemical substances (or by-products) developed in the laboratory are assumed to be hazardous in the absence of other information.

F. If a chemical substance is produced in the laboratory for distribution outside of the University confines, MSDS and labeling provisions per the OSHA A Hazard Communication Standard apply. An MSDS must be developed by the lab director to accompany the substance during transport.

II. EXPOSURE MONITORING

A. Employee exposures to OSHA-regulated substances shall not exceed the permissible exposure limits specified in 29 CFR Part 1910, Subpart Z: www.osha.gov

B. Employee exposures to any substance regulated by an OSHA standard shall be measured when there is reason to believe that exposure levels routinely exceed the action or permissible level. Lab employees are to notify the LS/PI if there is suspicion for significant exposure. Use of chemicals in a properly-functioning fume hood typically precludes this possibility.

C. The Department of Environmental Safety (405-3980) shall be consulted for assistance with exposure monitoring. The LS/PI is responsible for contacting DES if exposure monitoring is believed to be necessary.

- D. Results of personal monitoring shall be made available to the affected employee and LS/PI within five (5) days of receipt of the results by DES.
- E. The lab director must document that sampling results are reviewed with the affected worker(s).

III. MEDICAL PROGRAM

- A. First aid kits are to be supplied and maintained by the LS/PI. Additional non-emergency medical assistance, if required, is available at the University Health Center. Emergency medical assistance is available by calling 911. Emergency phone numbers shall be posted in each lab (UM Emergency Response Guide).
- B. Where medical consultations or examinations are provided, the examining physician shall be provided with the following information:
 - 1. The identity of the hazardous chemical(s) to which the employees may have been exposed.
 - 2. A description of the conditions under which the exposure occurred including quantitative exposure data if available.
 - 3. A description of the signs and symptoms of exposure that the employee is experiencing, if any. If the injured laboratory employee is transported by ambulance and is unable to provide this information at the time of treatment, a coworker should accompany the employee to the hospital.
- C. Medical examinations or consultations provided to employees shall be maintained at the University Health Center and available per the requirements of 1910.20 "Access to Employee Exposure and Medical Records." A written opinion from the examining physician shall be provided to the laboratory supervisor or Chemical Hygiene Officer. It shall include:
 - 1. Recommendations for further medical follow up.
 - 2. Results of the examination and associated tests.
 - 3. Any medical condition that places the employee at increased risk due to exposure to a hazardous substance found in the workplace.
 - 4. A statement that the employee has been informed of the results of the examination or consultation.
- D. Accidents
 - 1. Injuries, which occur in the laboratory must be immediately treated.
 - 2. Injuries requiring first aid may be treated using the first aid kit provided/maintained by the LS/PI in each lab.
 - 3. Emergency transport (ambulance) shall be contacted to respond to injuries requiring more extensive treatment.
 - 4. All injuries shall be investigated by the employee's immediate supervisor (or designate) and reported to the UM Chemical Hygiene Officer.
 - 5. Lab incidents (without injury) should also be reported and reviewed with the Chemical Hygiene Officer.

IV. EMERGENCY EQUIPMENT

- A. Each laboratory employee shall be familiar with the location, application, and correct ways to operate the following equipment.
 - 1. Fire extinguishers
 - 2. Fire alarms

3. Eye wash stations
4. First aid kits
5. Chemical response spill kits
6. Emergency shut-off on equipment
7. Location of emergency telephone numbers and telephones. Documentation of appropriate training shall be maintained by the LS/PI via the Lab Personnel Safety Check List that is signed by the employee and the LS/PI at time of training. The Checklist is available through the DES web page.

B. Safety Showers and Eyewashes

1. Safety showers and eyewashes should be within the work area for immediate emergency use if required.
2. Inspections:
 - a. Access to the eyewash should be checked at the beginning of each shift by a lab employee. A clear path must be maintained at all times.
 - b. Adequate eyewash flow should be observed by operating the device at least weekly for a one minute period. This flow test also serves to clear sediment or rust that may accumulate in piping.
3. Safety showers and eyewashes will be inspected annually by the Department of Facilities Management.

C. Fire Extinguishers

1. It is the responsibility of the Department of Facilities Management to oversee, select, maintain, and properly locate the fire extinguisher(s) in each laboratory.
2. Fire extinguishers should be provided within 30 feet of travel from the fire hazard(s) and located along normal paths of travel.
3. Access to fire extinguishers must be maintained and the location should be conspicuously marked.
4. The fire extinguisher type and size must be selected for the appropriate hazards. If combustible metals are present in a lab facility, the LS/PI must ensure that a class D extinguishing agent is available.
5. Each laboratory is responsible to notify the Department of Facilities Management (301) 405-2222 if:
 - a. Facility modifications require movement of the extinguisher
 - b. A different type of fire extinguisher is necessary due to the fire hazards present
 - c. An extinguisher has been discharged, or
 - d. An extinguisher needs service or repair.
6. The following items should be inspected monthly by laboratory personnel:
 - a. Extinguisher(s) are in designated locations.
 - b. Clear unobstructed access is maintained.
 - c. The pin should be in place and attached with an unbroken wire.
 - d. The indicator should be on full.
 - e. There should be no indication of physical damage.

D. Fire Alarms

1. Fire protection design and procedures are the responsibility of the University Fire Marshal.
2. The Department of Facilities Management, Life Safety Shop shall ensure that the following items are periodically inspected:
 - a. Fire alarms should be conspicuously marked.
 - b. Fire alarms will be activated to insure proper operation.

E. First Aid Kits

1. First aid kits should be available and maintained for treatment of minor injuries or for short-term emergency treatment before getting medical assistance.
2. First aid kits are to be inspected monthly and refilled as necessary.

V. EMERGENCY PROCEDURES

Prevention is necessary to ensure that emergencies do not occur. No emergency plan will do all things for all emergency situations. Preventive measures include: employee training, facility inspection programs, and engineering design of hazardous materials processes. Laboratory risks include accidents or injuries, chemical releases, release of radioactive or infectious aerosols, fires, explosions or other emergency situations.

A. An emergency response team has not been established at the University of Maryland. The University relies upon the local fire authority (Prince George's County) for any emergency response action. Laboratory occupants must call 911 for any situation that is determined to be an emergency. More information concerning emergency response is available from the Emergency Response Guide which is to be posted in each laboratory.

B. Chemical Spills

1. Laboratory personnel, upon experiencing a spill of hazardous material during normal laboratory activities, which is beyond their capability to safely clean up, and which presents an acute fire or health hazard shall contact 911 to report the spill as an emergency.
2. Examples of laboratory spills, which may be handled by lab personnel routinely, include, but are not limited to: broken thermometer, countertop spill of a hazardous chemical, and breakage of glassware containing small quantities of hazardous chemicals. The Department of Environmental is available for consultation and assistance.
3. Large spills may require special training and compliance with the OSHA Hazardous Waste Operations and Emergency Response Standard (HAZWOPER).

VI. EMPLOYEE TRAINING**A. Training**

1. All laboratory employees shall be trained on the hazards of chemicals present in their work area. The LS/PI is responsible for assuring all lab employees are appropriately trained.
2. The aim of the training program is to assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs. Training in the requirements of the OSHA Chemical Hygiene Standard is also required.
3. This training shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present. It shall also be provided prior to assignments involving new exposure situations. The training shall be arranged by the LS/PI. Orientation training the first week of fall and spring semesters is recommended for new graduate assistants and technicians.
4. All employees must also be trained and oriented by the LS/PI concerning lab standard operating procedures.

B. Reference Materials

1. Reference materials on the hazards, safe handling, storage and disposal of hazardous

chemicals are located at the table nearby eye wash station (electronic copy located at laboratory computer (folder "Safety").

2. Material safety data sheets (MSDS) shall be provided by the LS/PI (or designee) for all hazardous chemicals used in the laboratory at the table nearby eye wash station (electronic copy located at laboratory computer (folder "Safety").

3. The written Chemical Hygiene Plan and MSDS shall be available at all times that personnel are working in the laboratory.

VII. WASTE DISPOSAL PROCEDURES

A. Broken Glass

Equipment (broken beakers, pipets, etc. that are waste) should be promptly swept up and disposed of in rigid cardboard containers. When the container is full tape it shut. Place the box into the building's dumpster. Chemically-contaminated glassware may require handling and disposal as hazardous waste. Consult the LS/PI or DES for additional guidance.

B. Broken Thermometers (Mercury)

Immediately clean up broken glass and spilled mercury from broken thermometers. Do not handle mercury by hand. Enclose thermometer pieces in a sealed jar with a small amount of water over the mercury and follow chemical waste packaging instruction for disposal by DES. For larger spills that may require environmental monitoring and respiratory protection contact DES.

C. Chemicals

1. Each person working in the laboratory is responsible to ensure that all wastes are disposed of properly.

2. Waste disposal procedures must be in compliance with University, State and Federal regulations. All waste containers must be labeled with the contents and the date of accumulation. UM waste disposal procedures must be followed.

3. All lab employees responsible for packaging and processing wastes must take the Waste Generator training offered by DES on its web page.

4. Hoods shall not be used for disposal (i.e., evaporation) of volatile chemicals.

5. Drains shall not be used for disposal of chemicals unless it has specifically been approved by DES.

6. Chemical waste is removed from laboratories by DES who is also responsible for regulatory compliance once the waste is removed from the generation site.

7. Chemical waste generators are responsible for preparing and packaging chemical waste according to the "UM Hazardous And Regulated Waste Procedures Manual" available on the DES web page.

8. Container integrity is the responsibility of the generator. Containers must be compatible with the material inside and must be leak proof. Waste containers must be placed in secondary containment. Secondary containers (tubs) are available from DES.

9. Costs incurred as a result of packaging failure are the responsibility of the generating department.

10. All wastes given to DES for disposal must be identified. The cost for determining the identity of "unknowns" lies with the department. All departments are responsible for the proper disposal of any wastes left by faculty or staff who have left UM.

11. Any person shipping hazardous chemicals from the cite of generation must have specific training for safe transportation of those hazardous materials.
12. Special waste disposal such as low level radiation, infectious material, lead, asbestos as other regulated waste should be disposed of per UM procedures and according to applicable regulations. Contact DES for assistance.

VIII. VENTILATION

A. General

1. General laboratory ventilation shall provide airflow into the laboratory from non-laboratory areas and out to the exterior of the building (lab under negative pressure in general) through fume hoods or dedicated exhausts.
2. All laboratory doors should remain closed, except when being used for entrance and egress.
3. Local exhaust ventilation should not be located near doors, windows, air diffusers, fans or other sources of cross drafts.
4. All reactions that produce unpleasant and/or potentially hazardous fumes, vapors, or gases must be run within local exhaust systems (e.g., fume hoods).
5. Reactions or operations that produce corrosive vapors should be conducted in a hood lined with corrosion resistant material.
6. The sash of the hood is to be positioned to ensure adequate capture velocity. An inspection sticker from DES will indicate the maximum vertical sliding sash height or maximum number of horizontally-sliding doors to be opened when the hood is in use. Fume hoods are not to be used unless an inspection sticker indicates it is acceptable for use with hazardous materials.
7. Installation of local exhaust ventilation must be in accordance with air emission regulations. Technical assistance is available from DES and Facilities Management.
8. No devices or ducts are to be installed into existing exhaust or HVAC systems without the approval of the UM Facilities Management Department.
9. Do not install unsafe devices in hoods, such as extension cords or electric switches that are not "explosion proof" by design.
10. Perchloric acid must only be used in specialized hoods that are equipped with plumbing fixtures that wash the ductwork and internal hood surfaces to prevent deposition of explosive perchlorates. See DES for assistance.

B. Maintenance & Inspections

1. Daily Inspections by Lab Personnel
 - i. Visually inspect the hood area for excessive storage and other visible blockages.
 - ii. Observe the flow alarm (if so equipped) to ensure the device is performing properly. In the absence of a flow alarm, a piece of tissue paper may be taped to the bottom of the hood sash to visually confirm operation of the fume hood.
 - iii. Fume hood alarm systems must not be disabled or modified. If deficiencies are suspected, contact the Facilities Management Work Control Center (x52222) to report the malfunction.

2. Equipment installation/repairs are the responsibility of Facilities Management and periodic inspections are the responsibility of DES.

C. Ventilation Failure

1. Employees should initiate the following procedures when hood failure occurs or is suspected:
 - i. Close down or postpone the experiment if possible.
 - ii. Notify the LS/PI.

iii. Notify Facilities Management (x52222) to check and repair hood.

iv. Notify DES if consultation is needed.

VIII. CHEMICAL HANDLING PROCEDURES

A. General

Know as much as possible about the chemical you are handling. Read the label on the container, material safety data sheets, literature in the library, and consult with your peers or DES staff. Do not use any chemical material if you are unaware of the hazards associated with all avenues of exposure.

B. Flammable Liquids

1. Hazards

- i. Vapor can form an ignitable mixture in air.
- ii. Many flammable liquids are solvents and are potentially hazardous by inhalation.
- iii. Skin contact should be avoided, irritation or skin absorption are possible with some chemicals in this group.
- iv. Damage to the eyes range from irritation to severe damage.

2. Controls

- i. Work in the hood as much as possible.
- ii. Contact DES if materials will be transferred from drums into smaller containers to assure that proper anti-static measures are implemented.
- iii. All spills must be cleaned up immediately and the spill area properly decontaminated.
- iv. Emergency showers and eyewashes shall be used when skin or eye contact occurs. Get first aid attention immediately.

C. Corrosive Chemicals

1. Hazards

- i. Contact with the skin, eyes, respiratory, or digestive tract causes severe irritation, tissue damage, or burns. Burns may not be readily apparent after exposure to some acids (e.g., hydrofluoric).

2. Storage

- a. Store concentrated acids and bases in appropriate drip trays or plastic carrier if used frequently.
- b. Concentrated acids and bases should be transported in a plastic carrier.
- c. Oxidizing acids (nitric, sulfuric, perchloric) must be stored away from organic chemicals, paper, wood, or other flammables.
- d. Drip-tray residue must be removed daily.

3. Controls

- a. The following safety equipment will be utilized when handling corrosive chemicals: this laboratory does not use reactive Chemicals.
- b. In case of splashing to skin: Flush affected area with large amounts of water for at least 15 minutes. Remove contaminated clothing and discard during flushing process. Seek medical attention.
- c. Never add water to concentrated mineral acids or bases.

D. Reactive Chemicals

1. Hazards

- a. Water sensitive - react violently in the presence of water
- b. Pyrophoric materials - ignite in air at or below room temperature without additional heat, friction, or shock.

2. Storage
 - a. Water sensitive - follow label directions
 - b. Pyrophorics - store in an atmosphere of inert gas or under kerosene; exclude air.
 3. Controls
 - a. The following safety equipment will be utilized when handling reactive chemicals: this laboratory does not use reactive Chemicals.
 - b. Read the container label and follow special hazard instructions contained in the MSDS.
 - c. Use only in a fume hood unless specifically authorized otherwise by the LS/PI.
 4. Examples
 - a. Water sensitive:
 - Sodium
 - Potassium
 - Metal alkyls
 - Lithium ribbons
 - b. Pyrophoric Materials
 - Phosphorus
 - Metal alkyls
 - Silane
- E. Compressed Gases**
1. Hazards
 - a. Compressed gases contain gas under extreme pressure. Sudden release of this energy can cause serious injury and physical damage. Compressed gases may also be flammable, toxic, or corrosive.
 2. Storage
 - a. Compressed gases must be stored in the upright position with caps in place and secured with a strap, chain, base stand, or rack.
 - b. Storage of quantities of flammable compressed gases requires segregation of cylinders and specific storage methods (29 CFR 1910.101 (b)):
 - separate oxygen from fuel gases
 - proper use of regulators and gauges
 - properly labeled cylinders
 - cylinders must be properly secured during transport and stationary use
 - cylinder delivery issues (like left free standing in a hallway) must be established
 - static testing of cylinders
 3. Controls
 - a. Transport only with cap in place on suitable carrier.
 - b. Use only appropriate fittings and regulators.
 - c. Each gas type has special fittings.
 - d. Do not permit gases of one type to contaminate another type.
 - e. Use check valves and/or regulators.
 - f. Always open valves slowly and cautiously.
 - g. Do not let cylinder go completely empty.
 - h. Return "empty" cylinders to storage, clearly marked.
 4. Examples
 - Methane

- Argon
- Acetylene

F. Carcinogens, Mutagens, and Teratogens

1. Exposures

Exposures can potentially induce carcinogenesis, mutagenesis, and adverse reproductive outcomes.

2. Storage

- a. Store these chemicals in the hood.
- b. Maintain the minimum quantity necessary.

3. Controls

- a. Work in a designated and labeled area required by Chemical Hygiene Standard.
- b. Wear protective clothing.
- c. Work only with adequate engineering controls, such as hoods, glove boxes, etc.

4. Examples

- Benzene
- Vinyl chloride
- Lead

G. Toxic Metals

1. Hazards

- a. Toxic by inhalation, ingestion, and possible skin absorption.

2. Storage

- a. The minimum quantity necessary should be kept on hand.
- b. Store in specially designated area.

3. Controls

- a. Work in the hood as much as possible.
- b. Spills should be cleaned up immediately, with the work area properly decontaminated.
- c. Designate a specific area (and label) for hazardous work or carcinogen work.

4. Examples

- Lead
- Mercury
- Cadmium

VIII. WORK WITH SUBSTANCES OF MODERATE TO HIGH CHRONIC TOXICITY OR HIGH ACUTE TOXICITY (PARTICULARLY HAZARDOUS MATERIALS)

A. Use of designated areas

1. A designated area must be established for work with "select carcinogens", reproductive toxins, and substances, which have a high degree of chronic or acute toxicity.
2. This laboratory facility DOES NOT use Particularly Hazardous Materials.

LIST OF CHEMICALS:

Compressed Gases:

Acetylene
Argon
Nitrogen
Methane
Propane
Carbon monoxide
Carbon dioxide

Other:

Acetone
Ethyl Alcohol
Isopropyl Alcohol
Heptane
Methanol
Naphthalene
1-Propanol
Paraffin Oil
Fiberfrax
Kaowool
Superwool

Material Safety Data Sheet



Acetylene

Section 1. Chemical product and company identification

Product name : Acetylene
Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253
Product use : Synthetic/Analytical chemistry.
Synonym : acetylen; acetylene ; ethine; ethyne; narcylen
MSDS # : 001001
Date of Preparation/Revision : 5/11/2011.
In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas.
Emergency overview : WARNING!
FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.
Keep away from heat, sparks and flame. Do not puncture or incinerate container. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed.
Contact with rapidly expanding gases can cause frostbite.
Target organs : May cause damage to the following organs: lungs, upper respiratory tract, central nervous system (CNS).
Routes of entry : Inhalation
Potential acute health effects
Eyes : Contact with rapidly expanding gas may cause burns or frostbite.
Skin : Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation : Acts as a simple asphyxiant.
Ingestion : Ingestion is not a normal route of exposure for gases
Potential chronic health effects
Chronic effects : May cause target organ damage, based on animal data.
Target organs : May cause damage to the following organs: lungs, upper respiratory tract, central nervous system (CNS).
Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

| <u>Name</u> | <u>CAS number</u> | <u>% Volume</u> | <u>Exposure limits</u> |
|-------------|-------------------|-----------------|---|
| Acetylene | 74-86-2 | 100 | NIOSH REL (United States, 6/2009). CEIL: 2662 mg/m ³ CEIL: 2500 ppm |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Auto-ignition temperature** : 305°C (581°F)
- Flash point** : Closed cup: -18.15°C (-0.7°F).
- Flammable limits** : Lower: 2.5% Upper: 100%
- Products of combustion** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
- Fire hazards in the presence of various substances** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge, heat and oxidizing materials.
- Fire-fighting media and instructions** : In case of fire, use water spray (fog), foam or dry chemical.
- In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.
- Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Personal protection**
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
- The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

Ethyne

NIOSH REL (United States, 6/2009).

CEIL: 2662 mg/m³

CEIL: 2500 ppm

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

- Molecular weight** : 26.04 g/mole
- Molecular formula** : C₂H₂
- Melting/freezing point** : Sublimation temperature: -81.8°C (-115.2 to °F)
- Critical temperature** : 35.3°C (95.5°F)
- Vapor pressure** : 635 (psig)
- Vapor density** : 0.907 (Air = 1)
- Specific Volume (ft³/lb)** : 14.7058
- Gas Density (lb/ft³)** : 0.0691 (-80°C / -112 to °F)

Section 10. Stability and reactivity

- Stability and reactivity** : The product is stable.
- Incompatibility with various substances** : Extremely reactive or incompatible with the following materials: oxidizing materials.
- Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
- Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

- Chronic effects on humans** : May cause damage to the following organs: lungs, upper respiratory tract, central nervous system (CNS).
- Other toxic effects on humans** : No specific information is available in our database regarding the other toxic effects of this material to humans.
- Specific effects**
- Carcinogenic effects** : No known significant effects or critical hazards.
- Mutagenic effects** : No known significant effects or critical hazards.
- Reproduction toxicity** : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.



- Products of degradation** : Products of degradation: carbon oxides (CO, CO₂) and water.
- Environmental fate** : Not available.
- Environmental hazards** : This product shows a low bioaccumulation potential.
- Toxicity to the environment** : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|---------------------------|-----------|-------------------------|-------|-----------------------|---|---|
| DOT Classification | UN1001 | ACETYLENE, DISSOLVED | 2.1 | Not applicable (gas). |  | <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: 15 kg</p> |
| | | | | | | |

| Acetylene | | | | | | |
|------------------------------|--------|-------------------------|-----|-----------------------|---|--|
| TDG Classification | UN1001 | ACETYLENE, DISSOLVED | 2.1 | Not applicable (gas). |  | Explosive Limit and Limited Quantity Index 0 Passenger Carrying Ship Index 75 Passenger Carrying Road or Rail Index Forbidden Special provisions 38, 42 |
| Mexico Classification | UN1001 | ACETYLENE, DISSOLVED | 2.1 | Not applicable (gas). |  | - |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

U.S. Federal regulations

- TSCA 8(a) IUR:** Partial exemption
- United States inventory (TSCA 8b):** This material is listed or exempted.
- SARA 302/304/311/312 extremely hazardous substances:** No products were found.
- SARA 302/304 emergency planning and notification:** No products were found.
- SARA 302/304/311/312 hazardous chemicals:** Ethyne
- SARA 311/312 MSDS distribution - chemical inventory - hazard identification:**
Ethyne: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard
- Clean Air Act (CAA) 112 accidental release prevention - Flammable Substances:**
Acetylene

Clean Air Act (CAA) 112 regulated flammable substances: Ethyne

State regulations

- Connecticut Carcinogen Reporting:** This material is not listed.
- Connecticut Hazardous Material Survey:** This material is not listed.
- Florida substances:** This material is not listed.
- Illinois Chemical Safety Act:** This material is not listed.
- Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
- Louisiana Reporting:** This material is not listed.
- Louisiana Spill:** This material is not listed.
- Massachusetts Spill:** This material is not listed.
- Massachusetts Substances:** This material is listed.
- Michigan Critical Material:** This material is not listed.
- Minnesota Hazardous Substances:** This material is not listed.
- New Jersey Hazardous Substances:** This material is listed.
- New Jersey Spill:** This material is not listed.
- New Jersey Toxic Catastrophe Prevention Act:** This material is not listed.
- New York Acutely Hazardous Substances:** This material is not listed.
- New York Toxic Chemical Release Reporting:** This material is not listed.
- Pennsylvania RTK Hazardous Substances:** This material is listed.

Acetylene

Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada)

- : Class A: Compressed gas.
- Class B-1: Flammable gas.
- Class F: Dangerously reactive material.

CEPA Toxic substances: This material is not listed.

Canadian ARET: This material is not listed.

Canadian NPRI: This material is listed.

Alberta Designated Substances: This material is not listed.

Ontario Designated Substances: This material is not listed.

Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements

- : FLAMMABLE GAS.
- MAY CAUSE FLASH FIRE.
- MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
- CONTENTS UNDER PRESSURE.

Canada

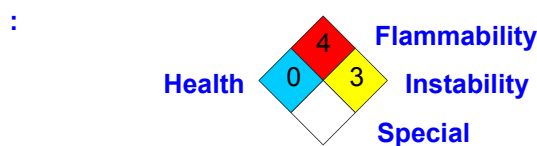
Label requirements

- : Class A: Compressed gas.
- Class B-1: Flammable gas.
- Class F: Dangerously reactive material.

Hazardous Material Information System (U.S.A.)

| | | |
|------------------|---|---|
| Health | * | 1 |
| Flammability | | 4 |
| Physical hazards | | 2 |
| | | |

National Fire Protection Association (U.S.A.)



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet



Argon

Section 1. Chemical product and company identification

| | |
|-------------------------------------|---|
| Product name | : Argon |
| Supplier | : AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253 |
| Product use | : Synthetic/Analytical chemistry. |
| Synonym | : argon, compressed; Cryogenic Liquid Argon, Liquid Argon |
| MSDS # | : 001004 |
| Date of Preparation/Revision | : 8/27/2010. |
| In case of emergency | : 1-866-734-3438 |

Section 2. Hazards identification

| | |
|---|---|
| Physical state | : Gas. [COLORLESS, ODORLESS INERT GAS OR LIQUID] |
| Emergency overview | : WARNING! GAS: CONTENTS UNDER PRESURE. Do not puncture or incinerate container. Can cause rapid suffocation. May cause severe frostbite. LIQUID: Extremely cold liquid and gas under pressure. Can cause rapid suffocation. May cause severe frostbite. Do not puncture or incinerate container. Contact with rapidly expanding gases or liquids can cause frostbite. |
| Routes of entry | : Inhalation |
| Potential acute health effects | |
| Eyes | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Skin | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Inhalation | : Acts as a simple asphyxiant. |
| Ingestion | : Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Potential chronic health effects | : CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. |
| Medical conditions aggravated by over-exposure | : Acute or chronic respiratory conditions may be aggravated by overexposure to this gas. |
| See toxicological information (section 11) | |

Section 3. Composition, Information on Ingredients

| <u>Name</u> | <u>CAS number</u> | <u>% Volume</u> | <u>Exposure limits</u> |
|-------------|-------------------|-----------------|-------------------------------|
| Argon | 7440-37-1 | 100 | Oxygen Depletion [Asphyxiant] |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : None expected.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : No specific data.
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.
Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.

Argon

- Storage** : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).
For additional information concerning storage and handling refer to Compressed Gas Association pamphlets P-1 Safe Handling of Compressed Gases in Containers and P-12 Safe Handling of Cryogenic Liquids available from the Compressed Gas Association, Inc.

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

When working with cryogenic liquids, wear a full face shield.

- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Insulated gloves suitable for low temperatures

- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

argon Oxygen Depletion [Asphyxiant]

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

- Molecular weight** : 39.95 g/mole
Molecular formula : Ar
Boiling/condensation point : -185.7°C (-302.3°F)
Melting/freezing point : -189.2°C (-308.6°F)
Critical temperature : -122.4°C (-188.3°F)
Vapor density : 1.38 (Air = 1). Liquid Density@BP: 87 lb/ft³ (1393 kg/m³)
Specific Volume (ft³/lb) : 9.70874
Gas Density (lb/ft³) : 0.103

Section 10. Stability and reactivity

- Stability and reactivity** : The product is stable.
Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Environmental fate : Not available.


Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.


Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|---------------------------|-----------|----------------------------|-------|-----------------------|---|---|
| DOT Classification | UN1006 | ARGON, COMPRESSED | 2.2 | Not applicable (gas). | | Limited quantity Yes. |
| | UN1951 | Argon, refrigerated liquid | | | | Packaging instruction Passenger aircraft Quantity limitation: 75 kg Cargo aircraft Quantity limitation: 150 kg |
| TDG Classification | UN1006 | ARGON, COMPRESSED | 2.2 | Not applicable (gas). |  | Explosive Limit and Limited Quantity Index 0.125 |
| | UN1951 | Argon, refrigerated liquid | | | | Passenger Carrying Road or Rail Index 75 Special provisions 42 |

Argon

| | | | | | | |
|------------------------------|--------|----------------------------|-----|-----------------------|---|---|
| Mexico Classification | UN1006 | ARGON, COMPRESSED | 2.2 | Not applicable (gas). |  | - |
| | UN1951 | Argon, refrigerated liquid | | | | |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

U.S. Federal regulations

- : TSCA 8(a) IUR: argon
- United States inventory (TSCA 8b):** This material is listed or exempted.
- SARA 302/304/311/312 extremely hazardous substances:** No products were found.
- SARA 302/304 emergency planning and notification:** No products were found.
- SARA 302/304/311/312 hazardous chemicals:** argon
- SARA 311/312 MSDS distribution - chemical inventory - hazard identification:** argon: Sudden release of pressure
- Clean Water Act (CWA) 307:** No products were found.
- Clean Water Act (CWA) 311:** No products were found.
- Clean Air Act (CAA) 112 accidental release prevention:** No products were found.
- Clean Air Act (CAA) 112 regulated flammable substances:** No products were found.
- Clean Air Act (CAA) 112 regulated toxic substances:** No products were found.

State regulations

- : **Connecticut Carcinogen Reporting:** This material is not listed.
- Connecticut Hazardous Material Survey:** This material is not listed.
- Florida substances:** This material is not listed.
- Illinois Chemical Safety Act:** This material is not listed.
- Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
- Louisiana Reporting:** This material is not listed.
- Louisiana Spill:** This material is not listed.
- Massachusetts Spill:** This material is not listed.
- Massachusetts Substances:** This material is listed.
- Michigan Critical Material:** This material is not listed.
- Minnesota Hazardous Substances:** This material is not listed.
- New Jersey Hazardous Substances:** This material is listed.
- New Jersey Spill:** This material is not listed.
- New Jersey Toxic Catastrophe Prevention Act:** This material is not listed.
- New York Acutely Hazardous Substances:** This material is not listed.
- New York Toxic Chemical Release Reporting:** This material is not listed.
- Pennsylvania RTK Hazardous Substances:** This material is listed.
- Rhode Island Hazardous Substances:** This material is not listed.

Canada

WHMIS (Canada)

- : Class A: Compressed gas.
- CEPA Toxic substances:** This material is not listed.
- Canadian ARET:** This material is not listed.
- Canadian NPRI:** This material is not listed.
- Alberta Designated Substances:** This material is not listed.
- Ontario Designated Substances:** This material is not listed.
- Quebec Designated Substances:** This material is not listed.

Section 16. Other information

United States

Label requirements

: GAS:
 CONTENTS UNDER PRESURE.
 Do not puncture or incinerate container.
 Can cause rapid suffocation.
 May cause severe frostbite.
 LIQUID:
 Extremely cold liquid and gas under pressure.
 Can cause rapid suffocation.
 May cause severe frostbite.

Canada

Label requirements

: Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)

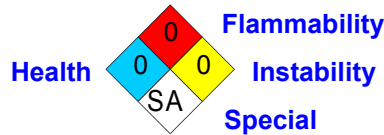
| | |
|------------------|---|
| Health | 0 |
| Flammability | 0 |
| Physical hazards | 0 |
| | |

liquid:

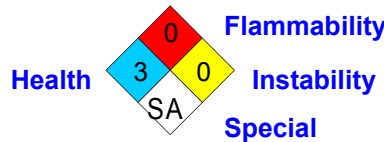
| | |
|---------------------|---|
| Health | 3 |
| Fire hazard | 0 |
| Reactivity | 0 |
| Personal protection | x |

National Fire Protection Association (U.S.A.)

:



liquid:



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Section 1. Chemical product and company identification

| | |
|-------------------------------------|---|
| Product name | : Nitrogen |
| Supplier | : AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253 |
| Product use | : Synthetic/Analytical chemistry. Liquid – cryogenic coolant. |
| Synonym | : nitrogen (dot); nitrogen gas; Nitrogen NF, LIN, Cryogenic Liquid Nitrogen, Liquid Nitrogen |
| MSDS # | : 001040 |
| Date of Preparation/Revision | : 1/14/2011. |
| In case of emergency | : 1-866-734-3438 |

Section 2. Hazards identification

| | |
|---|---|
| Physical state | : Gas. [NORMALLY A COLORLESS GAS: MAY BE A CLEAR COLORLESS LIQUID AT LOW TEMPERATURES. SOLD AS A COMPRESSED GAS OR LIQUID IN STEEL CYLINDERS.] |
| Emergency overview | : WARNING! GAS: CONTENTS UNDER PRESURE. Do not puncture or incinerate container. Can cause rapid suffocation. May cause severe frostbite. LIQUID: Extremely cold liquid and gas under pressure. Can cause rapid suffocation. May cause severe frostbite. Do not puncture or incinerate container. Contact with rapidly expanding gases or liquids can cause frostbite. |
| Routes of entry | : Inhalation |
| Potential acute health effects | |
| Eyes | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Skin | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Inhalation | : Acts as a simple asphyxiant. |
| Ingestion | : Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Medical conditions aggravated by over-exposure | : Acute or chronic respiratory conditions may be aggravated by overexposure to this gas. |

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

| <u>Name</u> | <u>CAS number</u> | <u>% Volume</u> | <u>Exposure limits</u> |
|-------------|-------------------|-----------------|-------------------------------|
| Nitrogen | 7727-37-9 | 100 | Oxygen Depletion [Asphyxiant] |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : None expected.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : Decomposition products may include the following materials:
nitrogen oxides
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.
- Storage** : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).
For additional information concerning storage and handling refer to Compressed Gas Association pamphlets P-1 Safe Handling of Compressed Gases in Containers and P-12 Safe Handling of Cryogenic Liquids available from the Compressed Gas Association, Inc.

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- Personal protection**
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
When working with cryogenic liquids, wear a full face shield.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Insulated gloves suitable for low temperatures
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

Nitrogen Oxygen Depletion [Asphyxiant]

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

- Molecular weight** : 28.02 g/mole
- Molecular formula** : N₂
- Boiling/condensation point** : -195.8°C (-320.4°F)
- Melting/freezing point** : -210°C (-346°F)
- Critical temperature** : -146.9°C (-232.4°F)
- Vapor density** : 0.967 (Air = 1) Liquid Density@BP: 50.46 lb/ft³ (808.3 kg/m³)
- Specific Volume (ft³/lb)** : 13.8889
- Gas Density (lb/ft³)** : 0.072

Section 10. Stability and reactivity

- Stability and reactivity** : The product is stable.
- Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
- Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

- Other toxic effects on humans** : No specific information is available in our database regarding the other toxic effects of this material to humans.
- Specific effects**
- Carcinogenic effects** : No known significant effects or critical hazards.
- Mutagenic effects** : No known significant effects or critical hazards.
- Reproduction toxicity** : No known significant effects or critical hazards.

Nitrogen

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|------------------------------|-----------|-------------------------------|-------|-----------------------|-------|---|
| DOT Classification | UN1066 | NITROGEN, COMPRESSED | 2.2 | Not applicable (gas). | | Limited quantity Yes. |
| | UN1977 | Nitrogen, refrigerated liquid | | | | Packaging instruction Passenger aircraft Quantity limitation: 75 kg Cargo aircraft Quantity limitation: 150 kg |
| TDG Classification | UN1066 | NITROGEN, COMPRESSED | 2.2 | Not applicable (gas). | | Explosive Limit and Limited Quantity Index 0.125 |
| | UN1977 | Nitrogen, refrigerated liquid | | | | Passenger Carrying Road or Rail Index 75 |
| Mexico Classification | UN1066 | NITROGEN, COMPRESSED | 2.2 | Not applicable (gas). | | - |
| | UN1977 | Nitrogen, refrigerated liquid | | | | |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations** : TSCA 8(a) IUR: Partial exemption
United States inventory (TSCA 8b): This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Nitrogen
SARA 311/312 MSDS distribution - chemical inventory - hazard identification:
Nitrogen: Sudden release of pressure
- State regulations** : **Connecticut Carcinogen Reporting**: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

- WHMIS (Canada)** : Class A: Compressed gas.
CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is not listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

- Label requirements** : GAS:
CONTENTS UNDER PRESURE.
Do not puncture or incinerate container.
Can cause rapid suffocation.
May cause severe frostbite.
LIQUID:
Extremely cold liquid and gas under pressure.
Can cause rapid suffocation.
May cause severe frostbite.

Canada

- Label requirements** : Class A: Compressed gas.

Nitrogen

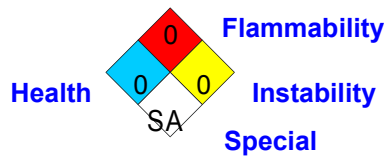
Hazardous Material Information System (U.S.A.)

| | |
|------------------|---|
| Health | 0 |
| Flammability | 0 |
| Physical hazards | 0 |
| | |

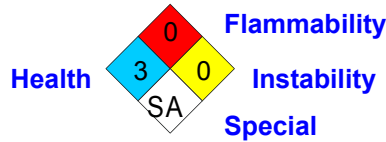
liquid:

| | |
|---------------------|---|
| Health | 3 |
| Fire hazard | 0 |
| Reactivity | 0 |
| Personal protection | |

National Fire Protection Association (U.S.A.)



liquid:



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet



Methane

Section 1. Chemical product and company identification

| | |
|-------------------------------------|---|
| Product name | : Methane |
| Supplier | : AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253 |
| Product use | : Synthetic/Analytical chemistry. |
| Synonym | : fire damp; marsh gas; methane (dot); methyl hydride |
| MSDS # | : 001033 |
| Date of Preparation/Revision | : 4/26/2010. |
| In case of emergency | : 1-866-734-3438 |

Section 2. Hazards identification

| | |
|---|--|
| Physical state | : Gas. [COLORLESS GAS; MAY BE A LIQUID UNDER PRESSURE OR REFRIGERATION.] |
| Emergency overview | : WARNING! GAS: CONTENTS UNDER PRESURE. Extremely flammable. May cause flash fire. Do not puncture or incinerate container. Can cause rapid suffocation. May cause severe frostbite. LIQUID: Extremely flammable. Extremely cold liquid and gas under pressure. Can cause rapid suffocation. May cause severe frostbite. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Use only with adequate ventilation. Keep container closed. Contact with rapidly expanding gases or liquids can cause frostbite. |
| Routes of entry | : Inhalation |
| Potential acute health effects | |
| Eyes | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Skin | : Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Inhalation | : Acts as a simple asphyxiant. |
| Ingestion | : Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns. |
| Potential chronic health effects | : CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. |
| Medical conditions aggravated by over-exposure | : Acute or chronic respiratory conditions may be aggravated by overexposure to this gas. |
| See toxicological information (section 11) | |

Section 3. Composition, Information on Ingredients

| Name | CAS number | % Volume | Exposure limits |
|---------|------------|----------|--|
| Methane | 74-82-8 | 100 | ACGIH TLV (United States, 1/2009). TWA: 1000 ppm 8 hour(s). |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Auto-ignition temperature** : 539.85°C (1003.7°F)
- Flash point** : Closed cup: -188.15°C (-306.7°F).
- Flammable limits** : Lower: 5% Upper: 15%
- Products of combustion** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
- Fire hazards in the presence of various substances** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
- Fire-fighting media and instructions** : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.
- Storage** : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).
For additional information concerning storage and handling refer to Compressed Gas Association pamphlets P-1 Safe Handling of Compressed Gases in Containers and P-12 Safe Handling of Cryogenic Liquids available from the Compressed Gas Association, Inc.

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Personal protection**
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
When working with cryogenic liquids, wear a full face shield.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Insulated gloves suitable for low temperatures
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

methane

ACGIH TLV (United States, 1/2009).

TWA: 1000 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Methane

Section 9. Physical and chemical properties

| | |
|--|--|
| Molecular weight | : 16.05 g/mole |
| Molecular formula | : C-H4 |
| Boiling/condensation point | : -161.6°C (-258.9°F) |
| Melting/freezing point | : -182.6°C (-296.7°F) |
| Critical temperature | : -82.4°C (-116.3°F) |
| Vapor density | : 0.55 (Air = 1) Liquid Density@BP: 26.5 lb/ft3 (424.5 kg/m3) |
| Specific Volume (ft³/lb) | : 23.6128 |
| Gas Density (lb/ft³) | : 0.04235 |

Section 10. Stability and reactivity

| | |
|--|--|
| Stability and reactivity | : The product is stable. |
| Incompatibility with various substances | : Extremely reactive or incompatible with the following materials: oxidizing materials. |
| Hazardous decomposition products | : Under normal conditions of storage and use, hazardous decomposition products should not be produced. |
| Hazardous polymerization | : Under normal conditions of storage and use, hazardous polymerization will not occur. |

Section 11. Toxicological information

Toxicity data

| | |
|--------------------------------------|--|
| Other toxic effects on humans | : No specific information is available in our database regarding the other toxic effects of this material to humans. |
|--------------------------------------|--|

Specific effects

| | |
|------------------------------|---|
| Carcinogenic effects | : No known significant effects or critical hazards. |
| Mutagenic effects | : No known significant effects or critical hazards. |
| Reproduction toxicity | : No known significant effects or critical hazards. |

Section 12. Ecological information

Aquatic ecotoxicity


Not available.

| | |
|------------------------------------|--|
| Products of degradation | : Products of degradation: carbon oxides (CO, CO ₂) and water. |
| Environmental fate | : Not available. |
| Environmental hazards | : No known significant effects or critical hazards. |
| Toxicity to the environment | : Not available. |



Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|---------------------------|-----------|--|-------|-----------------------|---|------------------------|
| DOT Classification | UN1971 | Methane, compressed or Methane or Natural gas, compressed (with high methane content)(Methane) | 2.1 | Not applicable (gas). |  | - |
| | UN1972 | Methane, refrigerated | | | | |

Methane

| | | | | | | |
|------------------------------|--------|--|-----|-----------------------|---|---|
| | | liquid | | | | |
| TDG Classification | UN1971 | (Methane)Methane, compressed or Methane or Natural gas, compressed (with high methane content) | 2.1 | Not applicable (gas). |  | Explosive Limit and Limited Quantity Index 0.125 ERAP Index 3000 Passenger Carrying Ship Index Forbidden Passenger Carrying Road or Rail Index Forbidden |
| | UN1972 | Methane, refrigerated liquid | | | | |
| Mexico Classification | UN1971 | (Methane)Methane, compressed or Methane or Natural gas, compressed (with high methane content) | 2.1 | Not applicable (gas). |  | - |
| | UN1972 | Methane, refrigerated liquid | | | | |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations**
- United States inventory (TSCA 8b):** This material is listed or exempted.
 - SARA 302/304/311/312 extremely hazardous substances:** No products were found.
 - SARA 302/304 emergency planning and notification:** No products were found.
 - SARA 302/304/311/312 hazardous chemicals:** methane
 - SARA 311/312 MSDS distribution - chemical inventory - hazard identification:** methane: Fire hazard, Sudden release of pressure
 - Clean Water Act (CWA) 307:** No products were found.
 - Clean Water Act (CWA) 311:** No products were found.
 - Clean Air Act (CAA) 112 accidental release prevention:** methane
 - Clean Air Act (CAA) 112 regulated flammable substances:** methane
 - Clean Air Act (CAA) 112 regulated toxic substances:** No products were found.

- State regulations**
- Connecticut Carcinogen Reporting:** This material is not listed.
 - Connecticut Hazardous Material Survey:** This material is not listed.
 - Florida substances:** This material is not listed.
 - Illinois Chemical Safety Act:** This material is not listed.
 - Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
 - Louisiana Reporting:** This material is not listed.
 - Louisiana Spill:** This material is not listed.
 - Massachusetts Spill:** This material is not listed.
 - Massachusetts Substances:** This material is listed.
 - Michigan Critical Material:** This material is not listed.
 - Minnesota Hazardous Substances:** This material is not listed.

Methane

New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada)

: Class A: Compressed gas.
 Class B-1: Flammable gas.
CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements

: GAS:
 CONTENTS UNDER PRESURE.
 Extremely flammable.
 May cause flash fire.
 Do not puncture or incinerate container.
 Can cause rapid suffocation.
 May cause severe frostbite.
 LIQUID:
 Extremely flammable.
 Extremely cold liquid and gas under pressure.
 Can cause rapid suffocation.
 May cause severe frostbite.

Canada

Label requirements

: Class A: Compressed gas.
 Class B-1: Flammable gas.

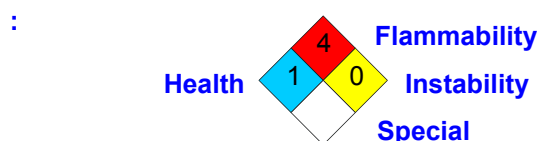
Hazardous Material Information System (U.S.A.)

| | |
|------------------|---|
| Health | 1 |
| Flammability | 4 |
| Physical hazards | 0 |
| | |

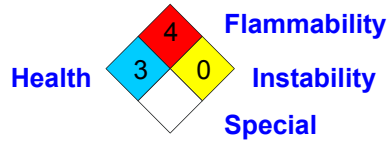
liquid:

| | |
|---------------------|---|
| Health | 3 |
| Fire hazard | 4 |
| Reactivity | 1 |
| Personal protection | |

National Fire Protection Association (U.S.A.)



liquid:



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Section 1. Chemical product and company identification

| | |
|-------------------------------------|--|
| Product name | : Propane |
| Supplier | : AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253 |
| Product use | : Synthetic/Analytical chemistry. |
| Synonym | : n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant. |
| MSDS # | : 001045 |
| Date of Preparation/Revision | : 4/26/2011. |
| In case of emergency | : 1-866-734-3438 |

Section 2. Hazards identification

| | |
|---|---|
| Physical state | : Gas. [COLORLESS LIQUEFIED COMPRESSED GAS; ODORLESS BUT MAY HAVE SKUNK ODOR ADDED.] |
| Emergency overview | : WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed. Contact with rapidly expanding gases can cause frostbite. |
| Target organs | : May cause damage to the following organs: the nervous system, heart, central nervous system (CNS). |
| Routes of entry | : Inhalation |
| Potential acute health effects | |
| Eyes | : Contact with rapidly expanding gas may cause burns or frostbite. |
| Skin | : Contact with rapidly expanding gas may cause burns or frostbite. |
| Inhalation | : Acts as a simple asphyxiant. |
| Ingestion | : Ingestion is not a normal route of exposure for gases |
| Potential chronic health effects | |
| Chronic effects | : May cause target organ damage, based on animal data. |
| Target organs | : May cause damage to the following organs: the nervous system, heart, central nervous system (CNS). |
| Medical conditions aggravated by over-exposure | : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product. |

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

| <u>Name</u> | <u>CAS number</u> | <u>% Volume</u> | <u>Exposure limits</u> |
|-------------|-------------------|-----------------|---|
| Propane | 74-98-6 | 100 | ACGIH TLV (United States, 2/2010). TWA: 1000 ppm 8 hour(s). NIOSH REL (United States, 6/2009). TWA: 1800 mg/m ³ 10 hour(s). TWA: 1000 ppm 10 hour(s). OSHA PEL (United States, 6/2010). TWA: 1800 mg/m ³ 8 hour(s). TWA: 1000 ppm 8 hour(s). OSHA PEL 1989 (United States, 3/1989). TWA: 1800 mg/m ³ 8 hour(s). TWA: 1000 ppm 8 hour(s). |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Auto-ignition temperature** : 450°C (842°F)
- Flash point** : Closed cup: -104°C (-155.2°F). Open cup: -104°C (-155.2°F).
- Flammable limits** : Lower: 2.1% Upper: 9.5%
- Products of combustion** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
- Fire hazards in the presence of various substances** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
- Fire-fighting media and instructions** : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Personal protection

- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

Propane

ACGIH TLV (United States, 2/2010).

TWA: 1000 ppm 8 hour(s).

NIOSH REL (United States, 6/2009).

TWA: 1800 mg/m³ 10 hour(s).

TWA: 1000 ppm 10 hour(s).

OSHA PEL (United States, 6/2010).

TWA: 1800 mg/m³ 8 hour(s).

TWA: 1000 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

TWA: 1800 mg/m³ 8 hour(s).

Propane

TWA: 1000 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

| | |
|--|-----------------------|
| Molecular weight | : 44.11 g/mole |
| Molecular formula | : C3-H8 |
| Boiling/condensation point | : -42°C (-43.6°F) |
| Melting/freezing point | : -189.7°C (-309.5°F) |
| Critical temperature | : 96.6°C (205.9°F) |
| Vapor pressure | : 109 (psig) |
| Vapor density | : 1.6 (Air = 1) |
| Specific Volume (ft³/lb) | : 8.6206 |
| Gas Density (lb/ft³) | : 0.116 |

Section 10. Stability and reactivity

| | |
|--|--|
| Stability and reactivity | : The product is stable. |
| Incompatibility with various substances | : Extremely reactive or incompatible with the following materials: oxidizing materials. |
| Hazardous decomposition products | : Under normal conditions of storage and use, hazardous decomposition products should not be produced. |
| Hazardous polymerization | : Under normal conditions of storage and use, hazardous polymerization will not occur. |

Section 11. Toxicological information

Toxicity data

| Product/ingredient name | Result | Species | Dose | Exposure |
|--------------------------------|-------------------------|----------------|-------------|-----------------|
| Propane | LC50 Inhalation Gas. | Rat | >800000 ppm | 15 minutes |

IDLH : 2100 ppm

Chronic effects on humans : May cause damage to the following organs: the nervous system, heart, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation : Products of degradation: carbon oxides (CO, CO₂) and water.

Environmental fate : Not available.

Environmental hazards : This product shows a low bioaccumulation potential.




Toxicity to the environment : Not available.

Propane

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|------------------------------|-----------|----------------------|-------|-----------------------|---|---|
| DOT Classification | UN1978 | PROPANE | 2.1 | Not applicable (gas). |  | Limited quantity Yes. Packaging instruction Passenger aircraft Quantity limitation: Forbidden. Cargo aircraft Quantity limitation: 150 kg Special provisions 19, T50 |
| TDG Classification | UN1978 | PROPANE | 2.1 | Not applicable (gas). |  | Explosive Limit and Limited Quantity Index 0.125 ERAP Index 3000 Passenger Carrying Ship Index 65 Passenger Carrying Road or Rail Index Forbidden Special provisions 29, 42 |
| Mexico Classification | UN1978 | PROPANE | 2.1 | Not applicable (gas). |  | - |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

U.S. Federal regulations : TSCA 8(a) IUR: Partial exemption
United States inventory (TSCA 8b): This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Propane
SARA 311/312 MSDS distribution - chemical inventory - hazard identification:
Propane: Fire hazard, Sudden release of pressure
Clean Air Act (CAA) 112 accidental release prevention - Flammable Substances:
Propane

Clean Air Act (CAA) 112 regulated flammable substances: Propane

State regulations : Connecticut Carcinogen Reporting: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.
CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements : FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

Canada

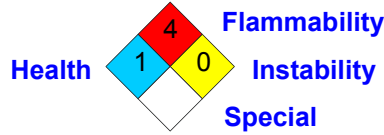
Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

Propane

Hazardous Material Information System (U.S.A.) :

| | | |
|------------------|---|---|
| Health | * | 1 |
| Flammability | | 4 |
| Physical hazards | | 0 |
| | | |

National Fire Protection Association (U.S.A.) :



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

Version 1.6
Revision Date 09/20/2004

MSDS Number 30000000023
Print Date 07/24/2005

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Carbon monoxide

Chemical formula : CO

Synonyms : Carbon monoxide, Carbonic Oxide, Carbon Oxide

Product Use Description : General Industrial

Company : Air Products and Chemicals, Inc
7201 Hamilton Blvd.
Allentown, PA 18195-1501

Telephone : 1-800-345-3148 Chemicals
1-800-752-1597 Gases and Electronic Chemicals

Emergency telephone number : 800-523-9374 USA
01-610-481-7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Components | CAS Number | Concentration (Volume) |
|-----------------|------------|------------------------|
| Carbon monoxide | 630-08-0 | 100 % |

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications.

3. HAZARDS IDENTIFICATION

Emergency Overview

Toxic by inhalation.
High pressure gas.
Extremely flammable.
May form explosive mixtures in air.
Immediate fire and explosion hazard exists when mixed with air at concentrations exceeding the lower flammability limit (LFL).
Do not breathe gas.
Self contained breathing apparatus (SCBA) may be required.

Potential Health Effects

Inhalation : May be fatal if inhaled.

Ingestion : Ingestion is not considered a potential route of exposure.

Exposure Guidelines

Primary Routes of Entry : Inhalation

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Target Organs : Respiratory system, cardiovascular system, central nervous system and blood.

Aggravated Medical Condition

Pre-existing respiratory conditions may be aggravated by over-exposure to Carbon Monoxide. Carbon Monoxide can aggravate some diseases of the cardiovascular system such as coronary artery disease and angina pectoris. Asthma.

Environmental Effects

Dangerous for the environment.

4. FIRST AID MEASURES

- General advice : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
- Eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
- Skin contact : Wash with water and soap as a precaution.
- Ingestion : Ingestion is not considered a potential route of exposure.
- Inhalation : In case of shortness of breath, give oxygen. Move to fresh air. Consult a doctor. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately.
- Notes to physician
- Treatment : Hyperbaric oxygen is the most efficient treatment of carbon monoxide and dramatically reduces the biological half-life of carboxyhemoglobin. Although less effective, 100% oxygen by mask is useful if hyperbaric facilities are not available. Stimulant drugs are not indicated.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : All known extinguishing media can be used.
- Specific hazards : If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken (e.g. total evacuation to protect persons from cylinder fragments and toxic fumes should a rupture occur). Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Combustion by-products may be toxic. Move away from container and cool with water from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. If possible, shut off the source of gas and allow the fire to burn itself out. Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire. Do not allow run-off from fire fighting to enter drains or water courses. Extinguish fire only if gas flow can be stopped.

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Special protective equipment for fire-fighters : Use self-contained breathing apparatus and chemically protective clothing.

6. ACCIDENTAL RELEASE MEASURES

- Personal precautions : Evacuate personnel to safe areas. Remove all sources of ignition. Approach suspected leak areas with caution. Never enter a confined space or other area where the flammable gas concentration is greater the 10% of its lower flammable limit. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area.
- Environmental precautions : Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
- Methods for cleaning up : Ventilate the area. Approach suspected leak areas with caution.
- Additional advice : If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the Air Products emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shocks which may cause damage to their valve or safety devices. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device

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in piping. Purge air from system before introducing gas. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Prolonged periods of cold temperature below -30°C (-20°F) should be avoided. All piped systems and associated equipment must be grounded.

Storage

Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Full containers should be stored so that oldest stock is used first. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Smoking should be prohibited within storage areas or while handling product or containers. Display "No Smoking or Open Flames" signs in the storage areas. The amounts of flammable or toxic gases in storage should be kept to a minimum. Return empty containers in a timely manner. Flammable storage areas should be separated from oxygen and other oxidizers by a minimum distance of 20 ft. (6.1 m.) or by a barrier of non-combustible material at least 5 ft. (1.5 m.) high, having a fire resistance rating of at least 1/2 hour.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations. Provide sufficient air exchange and/or exhaust in work rooms. Keep away from combustible material. All electrical equipment in the storage areas should be compatible with flammable materials stored. Containers containing flammable gases should be stored away from other combustible materials. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Handle product only in closed system or provide appropriate exhaust ventilation at machinery.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal protective equipment

- | | |
|--------------------------|---|
| Respiratory protection | : Keep self contained breathing apparatus readily available for emergency use. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Users of breathing apparatus must be trained. |
| Hand protection | : Sturdy work gloves are recommended for handling cylinders. The breakthrough time of the selected glove(s) must be greater than the intended use period. |
| Eye protection | : Safety glasses recommended when handling cylinders. |
| Skin and body protection | : Flame retardant antistatic protective clothing. |

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Safety shoes are recommended when handling cylinders.
Wear as appropriate:
Flame retardant protective clothing.

Special instructions for protection and hygiene : Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits. Ensure adequate ventilation, especially in confined areas.

Exposure limit(s)

| | | | |
|-----------------|---|---------|-----------------------|
| Carbon monoxide | Time Weighted Average (TWA): ACGIH | 25 ppm | - |
| Carbon monoxide | Recommended exposure limit (REL): NIOSH | 35 ppm | 40 mg/m ³ |
| Carbon monoxide | Ceiling Limit Value and Time Period (if specified): NIOSH | 200 ppm | 229 mg/m ³ |
| Carbon monoxide | PEL: OSHA Z1 | 50 ppm | 55 mg/m ³ |

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : Compressed gas.

Color : Colorless gas

Odor : No odor warning properties.

Molecular Weight : 28.01 g/mol

Relative vapor density : 0.967 (air = 1)

Relative density : 0.79 (water = 1)

Density : 0.075 lb/ft³ (0.0012 g/cm³) at 70 °F (21 °C)
Note: (as vapor)

Specific Volume : 13.80 ft³/lb (0.8615 m³/kg) at 70 °F (21 °C)

Boiling point/range : -313 °F (-191.5 °C)

Critical temperature : -220 °F (-140.2 °C)

Melting point/range : -337 °F (-205.1 °C)

Autoignition temperature : 1,148 °F (620 °C)

Upper flammability limit : 74 %(V)

Lower flammability limit : 12.5 %(V)

Water solubility : 0.030 g/l

10. STABILITY AND REACTIVITY

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Stability : Stable under normal conditions. Stable.

Conditions to avoid : Heat, flames and sparks.

Materials to avoid : Iron.
Natural rubber.
Neoprene.
Nickel.
Oxygen.
Oxidizing agents.

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion : No data is available on the product itself.

Inhalation : LC50 (1 h) : 3760 ppm
Species : Rat.

Skin. : No data is available on the product itself.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity : Carbon Monoxide is known to be harmful to aquatic life in very low concentrations.

Toxicity to other organisms : No data available.

Persistence and degradability

Mobility : Carbon Monoxide will not be mobile in the environment.

Bioaccumulation : Does not bioaccumulate.

Further information

This product has no known eco-toxicological effects.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with local and national regulations. Contact supplier if guidance is required. Return unused product in original cylinder to supplier. Must not be discharged to atmosphere.

Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

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CFR

Proper shipping name : Carbon monoxide, compressed
Class : 2.3 (2.1)
UN/ID No. : UN1016

IATA

Proper shipping name : Carbon monoxide, compressed
Class : 2.3 (2.1)
UN/ID No. : UN1016

IMDG

Proper shipping name : CARBON MONOXIDE, COMPRESSED
Class : 2.3 (2.1)
UN/ID No. : UN1016

CTC

Proper shipping name : CARBON MONOXIDE, COMPRESSED
Class : 2.3 (2.1)
UN/ID No. : UN1016

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Toxic Flammable. Compressed Gas.

| Country | Regulatory list | Notification |
|-------------|-----------------|------------------------|
| USA | TSCA | Included on Inventory. |
| EU | EINECS | Included on Inventory. |
| Canada | DSL | Included on Inventory. |
| Australia | AICS | Included on Inventory. |
| Japan | ENCS | Included on Inventory. |
| South Korea | ECL | Included on Inventory. |
| China | SEPA | Included on Inventory. |
| Philippines | PICCS | Included on Inventory. |

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Acute Health Hazard

Fire Hazard. Acute Health Hazard Sudden Release of Pressure Hazard.

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

WARNING! This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.

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Carbon monoxide

16. OTHER INFORMATION

NFPA Rating

| | | |
|-------------|---|---|
| Health | : | 2 |
| Fire | : | 4 |
| Instability | : | 0 |

HMIS Rating

| | | |
|-----------------|---|---|
| Health | : | 1 |
| Flammability | : | 4 |
| Physical hazard | : | 3 |

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
<http://www.airproducts.com/productstewardship/>

Material Safety Data Sheet

Version 1.7
Revision Date 09/27/2004

MSDS Number 30000000020
Print Date 07/24/2005

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Carbon Dioxide

Chemical formula : CO₂

Synonyms : Carbon dioxide, Carbonic Anhydride, Carbonic Acid Gas, Carbon Anhydride

Product Use Description : General Industrial

Company : Air Products and Chemicals, Inc
7201 Hamilton Blvd.
Allentown, PA 18195-1501

Telephone : 1-800-345-3148 Chemicals
1-800-752-1597 Gases and Electronic Chemicals

Emergency telephone number : 800-523-9374 USA
01-610-481-7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Components | CAS Number | Concentration (Volume) |
|----------------|------------|------------------------|
| Carbon dioxide | 124-38-9 | 100 % |

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications.

3. HAZARDS IDENTIFICATION

Emergency Overview

Can cause rapid suffocation.
Compressed liquefied gas.
Avoid breathing gas.
Direct contact with liquid can cause frostbite.
Self contained breathing apparatus (SCBA) may be required.

Potential Health Effects

Inhalation : Concentrations of 10% CO₂ or more can produce unconsciousness or death. In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themselves.

Eye contact : Contact with liquid may cause cold burns/frost bite.

Skin contact : Contact with liquid may cause cold burns/frost bite.

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Ingestion : Ingestion is not considered a potential route of exposure.

Chronic Health Hazard : Not applicable.

Exposure Guidelines

Primary Routes of Entry : Inhalation

Target Organs : None.

Symptoms : Shivering fit. Sweating. Blurred vision. Headache. Increased pulse rate. Shortness of breath. Rapid respiration. Exposure to oxygen deficient atmosphere may cause the following symptoms: Dizziness. Salivation. Nausea. Vomiting. Loss of mobility/consciousness.

Aggravated Medical Condition

None known.

4. FIRST AID MEASURES

- General advice : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
- Eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing. Seek medical advice.
- Skin contact : Wash frost-bitten areas with plenty of water. Do not remove clothing. Cover wound with sterile dressing.
- Ingestion : Ingestion is not considered a potential route of exposure.
- Inhalation : Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. In case of shortness of breath, give oxygen.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : All known extinguishing media can be used.
- Specific hazards : Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Move away from container and cool with water from a protected position. If possible, stop flow of product. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. Most cylinders are designed to vent contents when exposed to elevated temperatures.
- Special protective equipment for fire-fighters : Wear self contained breathing apparatus for fire fighting if necessary.

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6. ACCIDENTAL RELEASE MEASURES

- Personal precautions : Evacuate personnel to safe areas. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area. Monitor oxygen level.
- Environmental precautions : Should not be released into the environment. Do not discharge into any place where its accumulation could be dangerous. Prevent further leakage or spillage. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
- Methods for cleaning up : Ventilate the area.
- Additional advice : If possible, stop flow of product. Increase ventilation to the release area and monitor oxygen level. If leak is from cylinder or cylinder valve, call the Air Products emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Only experienced and properly instructed persons should handle compressed gases. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shocks which may cause damage to their valve or safety devices. Never attempt to lift a cylinder by its valve protection cap or guard. Always use backflow protective device in piping. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Prolonged periods of cold temperature below -30°C (-20°F) should be avoided. Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

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Storage

Full containers should be stored so that oldest stock is used first. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations. Keep away from combustible material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide natural or mechanical ventilation to prevent oxygen deficient atmospheres below 19.5% oxygen.

Personal protective equipment

- Respiratory protection : Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere. Air purifying respirators will not provide protection. Users of breathing apparatus must be trained.
- Hand protection : Sturdy work gloves are recommended for handling cylinders. The breakthrough time of the selected glove(s) must be greater than the intended use period.
- Eye protection : Safety glasses recommended when handling cylinders.
- Skin and body protection : Safety shoes are recommended when handling cylinders.
- Special instructions for protection and hygiene : Ensure adequate ventilation, especially in confined areas.

Exposure limit(s)

| | | | |
|----------------|---|------------|--------------|
| Carbon dioxide | Time Weighted Average (TWA): ACGIH | 5,000 ppm | - |
| Carbon dioxide | Short Term Exposure Limit (STEL): ACGIH | 30,000 ppm | - |
| Carbon dioxide | Recommended exposure limit (REL): NIOSH | 5,000 ppm | 9,000 mg/m3 |
| Carbon dioxide | Short Term Exposure Limit (STEL): NIOSH | 30,000 ppm | 54,000 mg/m3 |
| Carbon dioxide | PEL: OSHA Z1 | 5,000 ppm | 9,000 mg/m3 |

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : Liquefied gas.

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| | |
|------------------------|---|
| Color | : Colorless gas |
| Odor | : No odor warning properties. |
| Molecular Weight | : 44.01 g/mol |
| Relative vapor density | : 1.519 (air = 1) |
| Relative density | : 0.82 (water = 1) |
| Vapor pressure | : 831.04 psia (57.30 bar) at 68 °F (20 °C) |
| Density | : 0.112 lb/ft ³ (0.0018 g/cm ³) at 70 °F (21 °C) Note: (as vapor) |
| Specific Volume | : 8.74 ft ³ /lb (0.5456 m ³ /kg) at 70 °F (21 °C) |
| Boiling point/range | : -127 °F (-88.1 °C) |
| Critical temperature | : 88 °F (31.1 °C) |
| Melting point/range | : -70 °F (-56.6 °C) |
| Water solubility | : 2.000 g/l |

10. STABILITY AND REACTIVITY

Stability : Stable under normal conditions.

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion : No data is available on the product itself.
Inhalation : No data is available on the product itself.
Skin. : No data is available on the product itself.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity : No data is available on the product itself.
Toxicity to other organisms : No data available.

Persistence and degradability

Mobility : No data available.

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Bioaccumulation : No data is available on the product itself.

Further information

When discharged in large quantities may contribute to the greenhouse effect.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : Return unused product in original cylinder to supplier. Contact supplier if guidance is required.

Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

CFR

Proper shipping name : Carbon dioxide
Class : 2.2
UN/ID No. : UN1013

IATA

Proper shipping name : Carbon dioxide
Class : 2.2
UN/ID No. : UN1013

IMDG

Proper shipping name : CARBON DIOXIDE
Class : 2.2
UN/ID No. : UN1013

CTC

Proper shipping name : CARBON DIOXIDE
Class : 2.2
UN/ID No. : UN1013

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Compressed Gas.

| Country | Regulatory list | Notification |
|---------|-----------------|------------------------|
| USA | TSCA | Included on Inventory. |

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| | | |
|-------------|--------|------------------------|
| EU | EINECS | Included on Inventory. |
| Canada | DSL | Included on Inventory. |
| Australia | AICS | Included on Inventory. |
| Japan | ENCS | Included on Inventory. |
| South Korea | ECL | Included on Inventory. |
| China | SEPA | Included on Inventory. |
| Philippines | PICCS | Included on Inventory. |

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Sudden Release of Pressure Hazard.

Sudden Release of Pressure Hazard.

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

16. OTHER INFORMATION

NFPA Rating

Health : 1
Fire : 0
Instability : 0

HMIS Rating

Health : 1
Flammability : 0
Physical hazard : 3

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
<http://www.airproducts.com/productstewardship/>



14805 49th Street North • Clearwater, FL 33762
1-800-528-0997 U.S.A. only • (727) 523-8053 International

ACETONE

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name : **Acetone**
Uses : Industrial Solvent. Restricted to professional users.
Product Code : S1212, U8903, S1260

Manufacturer/Supplier : **Shell Chemicals Europe B.V.**
PO Box 8610
3009 AP Rotterdam
Netherlands

Telephone : +31 (0)10 231 7000
Fax : +31 (0)10 231 7180

Emergency Telephone Number : +31 (0)10 431 3233

2. COMPOSITION/INFORMATION ON INGREDIENTS

Material Formal Name : Propan-2-one
CAS No. : 67-64-1
INDEX No. : 606-001-00-8
EINECS No. : 200-662-2

3. HAZARDS IDENTIFICATION

Health Hazards : Vapours may cause drowsiness and dizziness. Slightly irritating to respiratory system. Repeated exposure may cause skin dryness or cracking. Irritating to eyes. Harmful: may cause lung damage if swallowed.

Signs and Symptoms : Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. Lung damage (scarring, bronchitis, emphysema) may be indicated by shortness of breath, especially on exertion, and may be accompanied by a chronic cough.

Aggravated Medical Condition : Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Skin. Respiratory system.

Safety Hazards : Highly flammable.

Material Safety Data Sheet

according to EC directive 2001/58/EC

4. FIRST AID MEASURES

- Inhalation** : Remove to fresh air. Do not attempt to rescue the victim unless proper respiratory protection is worn. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting, or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.
- Skin Contact** : Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available.
- Eye Contact** : Immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. Transport to the nearest medical facility for additional treatment.
- Ingestion** : DO NOT DELAY. Do not induce vomiting. If victim is alert, rinse mouth and drink 1/2 to 1 glass of water to help dilute the material. Do not give liquids to a drowsy, convulsing, or unconscious person. Transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

- Specific Hazards** : Containers exposed to intense heat from fires should be cooled with large quantities of water. The vapour is heavier than air, spreads along the ground and distant ignition is possible.
- Extinguishing Media** : Alcohol-resistant foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
- Protective Equipment for Firefighters** : Wear full protective clothing and self-contained breathing apparatus. Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.
- Additional Advice** : All storage areas should be provided with adequate fire fighting facilities. Keep adjacent containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

- Protective measures** : Handling equipment must be bonded and grounded (earthed) to prevent sparking. Extinguish any naked flames. Do Not smoke. Remove ignition sources. Avoid sparks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
- Clean Up Methods** : Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly. Remove with explosion-proof vacuum trucks or pump to storage/salvage vessels.

Material Safety Data Sheet

Additional Advice : Local authorities should be advised if significant spillages cannot be contained. Proper disposal should be evaluated based on regulatory status of this material (refer to Section 13), potential contamination from subsequent use and spillage, and regulations governing disposal in the local area. The vapour is heavier than air, spreads along the ground and distant ignition is possible.

7. HANDLING AND STORAGE

Handling : Avoid breathing of or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge.

Storage : Cleaning, inspection and maintenance of storage tanks is a specialist operation which requires the implementation of strict procedures and precautions. Keep away from flammables, oxidizing agents, and corrosives. The vapour is heavier than air. Beware of accumulation in pits and confined spaces.

Product Transfer : Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge.

Recommended Materials : For containers, or container linings use mild steel, stainless steel. For container paints, use epoxy paint, zinc silicate paint.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
Occupational Exposure Limits

| Material | Source | Type | ppm | mg/m3 | Notation |
|----------|--------|------|---------|-------|----------|
| Acetone | ACGIH | TWA | 500 ppm | | |
| | ACGIH | STEL | 750 ppm | | |

| | | |
|----------------------------|------------------------|--|
| Material Acetone | Source ACGIH | Hazard Designation Not classifiable as a human carcinogen. |
|----------------------------|------------------------|--|

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Eye washes and showers for emergency use. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Exhaust emission systems should be designed in accordance with local conditions; the air should always be moved away from the source of vapour generation and the person working at this point. Provide adequate ventilation in storage areas.

Personal Protective : Personal protective equipment (PPE) should meet



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according to EC directive 2001/58/EC

- Equipment** : recommended national standards. Check with PPE suppliers.
- Respiratory Protection** : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for organic gases and vapours [boiling point <65°C (149°F)] meeting EN371. Where air-filtering respirators are unsuitable (e.g., airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.
- Hand Protection** : Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: Nitrile rubber. PVC. Viton.
- Eye Protection** : Wear safety glasses or full face shield if splashes are likely to occur.
- Protective Clothing** : Use protective clothing which is chemical resistant to this material. Safety shoes and boots should also be chemical resistant.
- Environmental Exposure Controls** : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Eye washes and showers for emergency use. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Exhaust emission systems should be designed in accordance with local conditions; the air should always be moved away from the source of vapour generation and the person working at this point. Firewater monitors and deluge systems are recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance : Clear Liquid
- Odour : Characteristic
- pH : Not applicable.
- Boiling point : -95 °C / -139 °F
- Flash point : -18 °C / 0 °F (IP 170)
- Explosion / Flammability limits in air : ca. 2.1 - 13 %(V)
- Auto-ignition temperature : 540 °C / 1,004 °F (ASTM D-2155)
- Vapour pressure : 24.7 kPa at 20 °C / 68 °F
- Density : 790 - 792 kg/m³ at 20 °C / 68 °F (ASTM D-4052)
- Water solubility : at 20 °C / 68 °F Completely miscible.
- n-octanol/water partition coefficient (log Pow) : 0.2
- Dynamic viscosity : 0.33 mPa.s at 20 °C / 68 °F
- Vapour density (air=1) : 2 at 20 °C / 68 °F



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| | |
|---|---|
| Electrical conductivity | : 20 µS/m at 20 °C / 68 °F (ASTM D-4308) |
| Coefficient of expansion | : 0.0014 / °C |
| Dielectric constant | : 21.4 at 20 °C / 68 °F |
| Heat of vapourisation | : 525 kJ/kg °C |
| Refractive index | : 1.359 at 20 °C / 68 °F (ASTM D-1218) |
| Specific heat | : 2.14 kJ/kg °C at 20 °C / 68 °F |
| Saturated Vapour concentration (in air) | : 590 g/m ³ at 20 °C / 68 °F (estimated value(s)) |
| Thermal conductivity | : 0.16 W/m °C at 20 °C / 68 °F |
| Volatile organic carbon content | : 62 % (EC/1999/13) |
| Evaporation rate (nBuAc=1) | : 5.6 (ASTM D 3539, nBuAc=1) 2 (DIN 53170, di-ethyl ether=1) |
| Surface tension | : 22.8 mN/m at 20 °C / 68 °F |
| Molecular weight | : 58.08 g/mol |

10. STABILITY AND REACTIVITY

| | |
|---|---|
| Stability | : Stable under normal conditions of use. |
| Conditions to Avoid | : Avoid heat, sparks, open flames and other ignition sources. |
| Materials to Avoid | : Strong oxidising agents. |
| Hazardous Decomposition Products | : None expected under normal use conditions. |

11. TOXICOLOGICAL INFORMATION

| | |
|--|--|
| Basis for Assessment | : Information given is based on product testing. |
| Acute Oral Toxicity | : Low toxicity: LD50 >2000 mg/kg , Rat Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal. |
| Acute Dermal Toxicity | : Low toxicity: LD50 >2000 mg/kg , Rabbit |
| Acute Inhalation Toxicity | : Low toxicity: LC50 >20 mg/l Rat |
| Skin Irritation | : Not irritating to skin. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis. |
| Eye Irritation | : Irritating to eyes. |
| Sensitisation | : Not expected to be a skin sensitiser. |
| Repeated Dose Toxicity | : Low systemic toxicity on repeated exposure. |
| Mutagenicity | : Not mutagenic. |
| Carcinogenicity | : Not expected to be carcinogenic. |
| Reproductive and Developmental Toxicity | : Not expected to impair fertility. |
| Additional Information | : Exposure may enhance the toxicity of other materials |

12. ECOLOGICAL INFORMATION

| | |
|------------------------------|--|
| Acute Toxicity | |
| Fish | : Low toxicity: LC/EC/IC50 > 1000 mg/l |
| Aquatic Invertebrates | : Low toxicity: LC/EC/IC50 > 1000 mg/l |
| Algae | : Low toxicity: LC/EC/IC50 > 1000 mg/l |
| Microorganisms | : Low toxicity: LC/EC/IC50 > 1000 mg/l |
| Mobility | : If product enters soil, it will be mobile and may contaminate groundwater. |



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Persistence/degradability : Dissolves in water.
: Readily biodegradable.
Bioaccumulation : Not expected to bioaccumulate significantly.

13. DISPOSAL CONSIDERATIONS

Material Disposal : Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.

Container Disposal : Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard. Do not puncture, cut or weld uncleaned drums. Send to drum recoverer or metal reclaimer.

14. TRANSPORT INFORMATION

ADR
Class : 3
Packing group : II
Classification code : F1
Hazard identification no. : 33
UN No. : 1090
Danger label (primary risk) : 3
Proper shipping name : ACETONE

RID
Class : 3
Packing group : II
Classification code : F1
Hazard identification no. : 33
UN No. : 1090
Danger label (primary risk) : 3
Proper shipping name : ACETONE

IMDG
Identification number : UN 1090
Proper shipping name : ACETONE
Class / Division : 3
Packing group : II
Marine pollutant: No

IATA (Country variations may apply)
UN No. : 1090
Proper shipping name : Acetone
Class / Division : 3
Packing group : II



Material Safety Data Sheet

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material

| | | |
|----------------------|---|--|
| EC Label Name | : | ACETONE |
| EC label/EC Number | : | 200-662-2 |
| EC Classification | : | Highly flammable. Irritant. |
| EC Annex I Number | : | 606-001-00-8 |
| EC Symbols | : | F Highly flammable. Xi Irritant. |
| EC Risk Phrases | : | R11 Highly flammable. R36 Irritating to eyes. R66 Repeated exposure may cause skin dryness or cracking. R67 Vapours may cause drowsiness and dizziness. |
| EC Safety Phrases | : | S9 Keep container in a well-ventilated place. S16 Keep away from sources of ignition - No smoking. S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. |
| AICS | : | Listed. |
| DSL | : | Listed. |
| INV (CN) | : | Listed. |
| ENCS (JP) | : | Listed. (2)-542 |
| TSCA | : | Listed. |
| EINECS | : | Listed. 200-662-2 |
| KECI (KR) | : | Listed. KE-29367 |
| PICCS (PH) | : | Listed. |
| National Legislation | : | |
| OE_HP | : | Listed. |

16. OTHER INFORMATION

R-phrase(s)

| | |
|-----|---|
| R11 | Highly flammable. |
| R36 | Irritating to eyes. |
| R66 | Repeated exposure may cause skin dryness or cracking. |
| R67 | Vapours may cause drowsiness and dizziness. |

| | | |
|----------------------------|---|---|
| MSDS Version Number | : | 1 |
| MSDS Effective Date | : | 23.07.2003 |
| MSDS Revisions | : | A vertical bar () in the left margin indicates an amendment from the previous version. |
| MSDS Regulation | : | The content and format of this safety data sheet is in accordance with Commission Directive 2001/58/EC of 27 July 2001, amending for the second time Commission Directive 91/155/EEC. |
| MSDS Distribution | : | The information in this document should be made available to |



Shell Chemicals

Acetone
Version 1.3

Effective Date 23.07.2003

Material Safety Data Sheet

according to EC directive 2001/58/EC

Disclaimer

all who may handle the product
: This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

EMS CATALOG NO: 15055
EMS PRODUCT: Ethyl Alcohol
200 Proof
DATE: October 26, 2001
PAGE NUMBER: One of 8

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.

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
P.O. BOX 251

FORT WASHINGTON, PA 19034
(215) 646-1566

24 HOUR EMERGENCY PHONE #
CHEMTREC: (800) 424-9300

FOR PRODUCT AND SALES INFORMATION

CONTACT ELECTRON MICROSCOPY SCIENCES OFFICE ABOVE.

PRODUCT IDENTIFICATION

PRODUCT NAME: Ethyl Alcohol 200 proof
CAS NUMBER: 64-17-5
% BY WEIGHT: 100
TWA (mg/m³): 1900
CHEMICAL FORMULA: CH₃CH₂OH
SYNONYM: Ethanol
CHEMICAL FAMILY: Aliphatic alcohol or glycol (Solvent.)
RTECS: K000000
TSCA: On the TSCA list

TOXICOLOGICAL DATA ON INGREDIENTS

ORAL (LD50): ACUTE: 7060 mg/kg (Rat).
VAPOR (LD50): ACUTE: 8000 ppm (Rat.) (4 hour(s)).

HAZARDS IDENTIFICATION

POTENTIAL ACUTE HEALTH EFFECTS:

Very dangerous in case of skin contact (irritant). Slightly dangerous to dangerous in case of eye contact (irritant). Very slightly to slightly dangerous in case of ingestion, of inhalation. Severe over-exposure can result in death. Can be fatal if inhaled or ingested. This product may irritate eyes and skin upon contact.

POTENTIAL CHRONIC HEALTH EFFECTS:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

This substance is toxic to the reproductive system. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

TOXICITY OF THE PRODUCT TO THE REPRODUCTIVE SYSTEM:

WARNING: This product contains a chemical known to the State of California to cause cancer.

Chemical ingredient(s) requiring this warning:

Ethyl Alcohol 200 proof

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Chemical ingredient(s) requiring this warning:

Ethyl alcohol 200 proof.

FIRST AID MEASURES

EYE CONTACT:

Check for and remove any contact lenses. IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. COLD water may be used. DO NOT use an eye ointment. Seek medical attention.

SKIN CONTACT:

If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical touches the victim's exposed skin, such as the hands: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and grain. COLD water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

SERIOUS SKIN CONTACT :

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

INHALATION:

Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

SERIOUS INHALATION:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt, or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious, or corrosive. Seek immediate medical attention.

INGESTION:

DO NOT induce vomiting. Have conscious person drink several glasses of water or milk. Seek immediate medical attention.

SERIOUS INGESTION:

DO NOT induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

| |
|--------------------------------|
| FIRE AND EXPLOSION DATA |
|--------------------------------|

FLAMMABILITY OF THE PRODUCT: Flammable.

AUTO-IGNITION TEMPERATURE: 422°C (791.6°F)

FLASH POINTS: Closed cup: 12.78°C (55°F)

Open cup: 12.78°C (55°F) (Cleveland)

FLAMMABLE LIMITS: Lower: 3.3%

Upper: 19%

PRODUCTS OF COMBUSTION: These products are carbon oxides (CO, CO₂)

FIRE HAZARDS IN PRESENCE OF VARIOUS SUBSTANCES: Slightly flammable to flammable in presence of open flames and sparks, of heat. Very slightly to slightly flammable in presence of oxidizing materials.

EXPLOSION HAZARDS IN PRESENCE OF VARIOUS SUBSTANCES:

RISKS OF EXPLOSION OF THE PRODUCT IN PRESENCE OF OPEN FLAMES AND SPARK: Not available.

RISKS OF EXPLOSION OF THE PRODUCT IN PRESENCE OF MECHANICAL IMPACT: Not available.

RISKS OF EXPLOSION OF THE PRODUCT IN PRESENCE OF STATIC DISCHARGE: Not available.

No specific information is available in our database regarding the product's risks of explosion in the presence of various materials.

FIRE FIGHTING MEDIA AND INSTRUCTIONS: Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemicals, CO₂, alcohol foam or water spray.

LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

SPECIAL REMARKS ON FIRE HAZARDS: Containers should be grounded.

SPECIAL REMARKS ON EXPLOSION HAZARDS: No additional remark.

ACCIDENTAL RELEASE MEASURES

SMALL SPILL:

Dilute with water and mop up, or absorb with an inert DRY material and place in an appropriate waste disposal container.

LARGE SPILL:

Flammable liquid. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. DO NOT touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all sources of ignition.

HANDLING AND STORAGE

PRECAUTIONS:

Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. DO NOT ingest. Do not breathe gas, fumes, vapor or spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles as oxidizing agents.

STORAGE:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash station and safety shower is proximal to the work-station location.

PERSONAL PROTECTION:

Splash goggles. Lab coat. Vapor respirator. Be sure to use a MSHA/NIOSH approved respirator or equivalent. Gloves (impervious). Wear appropriate respirator when ventilation is inadequate.

PERSONAL PROTECTION IN CASE OF A LARGE SPILL:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

EXPOSURE LIMITS: TWA: 1000 (ppm) from OSHA/NIOSH

TWA: 1900 (mg/m³) from OSHA

Consult local authorities for acceptable exposure limits.

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE: Liquid (liquid)

ODOR: Alcohol like. (Strong)

TASTE: Pungent.

COLOR: Colorless.

MOLECULAR WEIGHT: 46.07

pH(1% SOLN/WATER): 7

BOILING POINT: 78.5°C (173.3°F)

MELTING POINT: -114.1°C (-173.4°F)

CRITICAL TEMPERATURE: Not available.

SPECIFIC GRAVITY: 0.79 (Water = 1)

VAPOR PRESSURE: 43 mm of Hg (@ 20°C)

VAPOR DENSITY: 1.59 (Air = 1)

VOLATILITY: Not available.

ODOR THRESHOLD: Not available.

WATER/OIL DIST. COEFF.: Not available.

IONICITY (IN WATER): Not available.

DISPERSION PROPERTIES: See solubility in water, methanol, diethyl ether.

SOLUBILITY: Easily soluble in cold water, hot water, methanol, diethyl ether.

STABILITY AND REACTIVITY DATA

STABILITY: The product is stable.
INSTABILITY TEMPERATURE: Not available.
CONDITIONS OF INSTABILITY: No additional remark.
INCOMPATIBILITY WITH VARIOUS SUBSTANCES:
CORROSIVITY: Slightly reactive to reactive with oxidizing agents.
CORROSIVITY: Non corrosive in presence of glass.
SPECIAL REMARKS ON REACTIVITY: No additional remark.
SPECIAL REMARKS ON CORROSIVITY: No additional remark.
POLYMERIZATION: No.

TOXICOLOGICAL INFORMATION

ROUTES OF ENTRY: Ingestion.
TOXICITY TO ANIMALS:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

ACUTE ORAL TOXICITY (LD50): 7060 mg/kg (Rat.)
ACUTE TOXICITY OF THE VAPOR (LC50): 8000 ppm (Rat).

CHRONIC EFFECTS ON HUMANS: The substance is toxic to the reproductive system.

OTHER TOXIC EFFECTS ON HUMANS:
Very dangerous in case of skin contact (irritant). Slightly dangerous to dangerous in case of eye contact (irritant). Very slightly to slightly dangerous in case of ingestion, and of inhalation.

SPECIAL REMARKS ON TOXICITY TO ANIMALS: No additional remark.

SPECIAL REMARKS ON CHRONIC EFFECTS ON HUMANS: No additional remark.

SPECIAL REMARKS ON OTHER TOXIC EFFECTS ON HUMANS:
Moderately toxic and narcotic in high concentrations. Experimentally tumorigen.

ECOLOGICAL INFORMATION

ECOTOXICITY: Not available.
BOD5 AND COD: Not available.
PRODUCTS OF BIODEGRADATION: These products are carbon oxides (CO, CO₂).
TOXICITY OF THE PRODUCTS OF BIODEGRADATION: SPECIAL REMARKS ON THE PRODUCTS OF BIODEGRADATION: The products of degradation are more toxic.
SPECIAL REMARKS ON THE PRODUCTS OF BIODEGRADATION: No additional remark.

DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Recycle to process, if possible. Consult your local or regional authorities.

TRANSPORT INFORMATION

DOT CLASSIFICATION: DOT CLASS 3: Flammable liquid.
IDENTIFICATION: Ethanol UN1170 II
SPECIAL PROVISIONS FOR TRANSPORT: No additional remark.

OTHER REGULATORY INFORMATION

FEDERAL AND STATE REGULATIONS:

The following product(s) is (are) listed by the State of California: (Cancer) Ethyl alcohol 200 proof

The following product(s) is (are) listed by the State of California: (Development toxin) Ethyl alcohol 200 proof

The following product(s) is (are) listed by the State of Massachusetts: Ethyl alcohol 200 proof

The following product(s) is (are) listed by the State of Pennsylvania: Ethyl alcohol 200 proof

The following product(s) is (are) listed on TSCA: Ethyl alcohol 200 proof

CALIFORNIA PROPOSITION 65 WARNINGS:

WARNING: this product contains a chemical known to the State of California to cause cancer.

Chemical ingredient(s) requiring this warning: Ethyl Alcohol 200 proof

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Chemical ingredient(s) requiring this warning: Ethyl Alcohol 200 proof

OTHER REGULATIONS:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):

OTHER CLASSIFICATIONS:

WHMIS (Canada): WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEQ): R12 Extremely flammable.

R20 Harmful by inhalation.

R38 Irritating to skin.

HMS (U.S.A.)

HEALTH HAZARD 2

FIRE HAZARD 3

REACTIVITY 0

PERSONAL PROTECTION j

NATIONAL FIRE PROTECTION ASSOCIATION (U.S.A.)

HEALTH 0

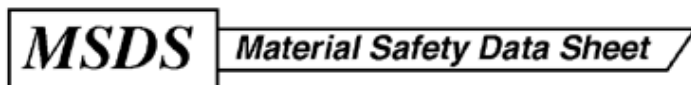
FLAMMABILITY 3

REACTIVITY 0

SPECIFIC HAZARD

PROTECTIVE EQUIPMENT:

Gloves (impervious). Lab coat. Vapor respirator. Be sure to use a MSHA/NIOSH approved respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

MSDS Number: **18840** * * * * * *Effective Date: 05/04/07* * * * * * *Supersedes: 08/27/04*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ISOPROPYL ALCOHOL (90 - 100%)

1. Product Identification

Synonyms: 2-Propanol; sec-propyl alcohol; isopropanol; sec-propanol; dimethylcarbinol

CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: (CH₃)₂CHOH

Product Codes:

J.T. Baker: 0562, 5082, 9037, 9080, U298

Mallinckrodt: 0562, 3027, 3031, 3032, 3035, 3037, 3043, 4359, 6569, H604, H982, V555, V566, V681

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------------|-----------|-----------|-----------|
| Isopropyl Alcohol | 67-63-0 | 90 - 100% | Yes |
| Water | 7732-18-5 | 0 - 10% | No |

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES;
CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation of vapors irritates the respiratory tract. Exposure to high concentrations has a narcotic effect, producing symptoms of dizziness, drowsiness, headache, staggering, unconsciousness and possibly death.

Ingestion:

Can cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (8 ounces).

Skin Contact:

May cause irritation with redness and pain. May be absorbed through the skin with possible systemic effects.

Eye Contact:

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

Chronic Exposure:

Chronic exposure may cause skin effects.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this agent.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Call a physician if irritation develops.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 12C (54F) CC

Autoignition temperature: 399C (750F)

Flammable limits in air % by volume:

lel: 2.0; uel: 12.7

Listed fire data is for Pure Isopropyl Alcohol.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse

vapors.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Small quantities of peroxides can form on prolonged storage. Exposure to light and/or air significantly increases the rate of peroxide formation. If evaporated to a residue, the mixture of peroxides and isopropanol may explode when exposed to heat or shock.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Isopropyl Alcohol (2-Propanol):

-OSHA Permissible Exposure Limit (PEL):

400 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

200 ppm (TWA), 400 ppm (STEL), A4 - not classifiable as a human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene and nitrile rubber are recommended materials.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Rubbing alcohol.

Solubility:

Miscible in water.

Specific Gravity:

0.79 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

82C (180F)

Melting Point:

-89C (-128F)

Vapor Density (Air=1):

2.1

Vapor Pressure (mm Hg):

44 @ 25C (77F)

Evaporation Rate (BuAc=1):

2.83

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Heat, flame, strong oxidizers, acetaldehyde, acids, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, aluminum, oleum and perchloric acid.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5045 mg/kg; skin rabbit LD50: 12.8 gm/kg; inhalation rat LC50: 16,000 ppm/8-hour; investigated as a tumorigen, mutagen, reproductive effector.

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|--------------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| -----\Cancer Lists\----- | | | |

Isopropyl Alcohol (67-63-0)
Water (7732-18-5)

No
No

No
No

3
None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material may biodegrade to a moderate extent. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

Environmental Toxicity:

The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: ISOPROPANOL
Hazard Class: 3
UN/NA: UN1219
Packing Group: II
Information reported for product/size: 200L

15. Regulatory Information

| -----\Chemical Inventory Status - Part 1\----- | | | | |
|--|------|-----|-------|-----------|
| Ingredient | TSCA | EC | Japan | Australia |
| Isopropyl Alcohol (67-63-0) | Yes | Yes | Yes | Yes |
| Water (7732-18-5) | Yes | Yes | Yes | Yes |

-----\Chemical Inventory Status - Part 2\-----

| Ingredient | --Canada-- | | | |
|-----------------------------|------------|-----|------|-------|
| | Korea | DSL | NDSL | Phil. |
| Isopropyl Alcohol (67-63-0) | Yes | Yes | No | Yes |
| Water (7732-18-5) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------|-----|--------------------|----------------|
| Ingredient | -SARA 302- | | -----SARA 313----- | |
| | RQ | TPQ | List | Chemical Catg. |
| Isopropyl Alcohol (67-63-0) | No | No | Yes | No |
| Water (7732-18-5) | No | No | No | No |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|--------|--------|
| Ingredient | CERCLA | -RCRA- | -TSCA- |
| | | 261.33 | 8 (d) |
| Isopropyl Alcohol (67-63-0) | No | No | No |
| Water (7732-18-5) | No | No | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2[S]2

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

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

Label Hazard Warning:

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

Label Precautions:

- Keep away from heat, sparks and flame.
- Keep container closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- Avoid breathing vapor or mist.
- Avoid contact with eyes, skin and clothing.

Label First Aid:

If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

 Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)



MATERIAL SAFETY DATA SHEET

Low Aromatic Commercial Grade Heptane

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Low Aromatic Commercial Grade Heptane
Intended Use: Solvent
Chemical Family: Aliphatic hydrocarbon

Responsible Party: ConocoPhillips Specialty Solvents
PO Box 358
Borger, Texas
79008-0358

Customer Service: 800-696-4240
<http://solvents.conocophillips.com>

Technical Information: 800-696-4240

The intended use of this product is indicated above. If any additional use is known, please contact us at the Technical Information number listed.

EMERGENCY OVERVIEW

24 Hour Emergency Telephone Numbers:

Spill, Leak, Fire or Accident Call CHEMTREC:

North America: (800) 424-9300

Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3219

Health Hazards/Precautionary Measures: Causes skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Wear appropriate personal protective equipment. Do not taste or swallow.

Physical Hazards/Precautionary Measures: Keep away from heat, sparks, flames, static electricity or other sources of ignition. Extremely flammable liquid and vapor. Vapor can cause flash fire.

Appearance: Colorless
Physical Form: Liquid
Odor: Mild

NFPA 704 Hazard Class:

Health: 1 (Slight)
Flammability: 3 (High)
Instability: 0 (Least)

HMIS Hazard Class:

Health: 2 (Moderate)
Flammability: 3 (High)
Physical Hazards: 0 (Least)

2. COMPOSITION / INFORMATION ON INGREDIENTS

| HAZARDOUS COMPONENTS | | | | | |
|---|-------------|-----------------------------|-------------|--------------|--------------|
| Component / CAS No: | Percent (%) | ACGIH: | OSHA: | NIOSH: | Other: |
| Heptane, Branched, Cyclic and Linear 426260-76-6 | 96-99 | 400 ppm TWA 500 ppm STEL | 500 ppm TWA | 750 ppm IDLH | As n-Heptane |
| n-Heptane 142-82-5 | 1-4 | 400 ppm TWA 500 ppm STEL | 500 ppm TWA | 750 ppm IDLH | NE |

All components are listed on the TSCA inventory.

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.

NE=Not Established

3. HAZARDS IDENTIFICATION

Potential Health Effects:

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Skin irritant. Contact may cause redness, itching, burning, and skin damage. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin, leading to dermatitis (inflammation). No information available on skin absorption.

Inhalation (Breathing): Low to moderate degree of toxicity by inhalation.

Ingestion (Swallowing): Low degree of toxicity by ingestion. ASPIRATION HAZARD - This material can enter lungs during swallowing or vomiting and cause lung inflammation and damage.

Signs and Symptoms: Effects of overexposure may include coughing, nausea, vomiting, diarrhea, transient excitation followed by signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue), irritation of the digestive tract, irritation of the nose and throat.

Cancer: No data available.

Target Organs: No data available for this material.

Developmental: No data available for this material.

Other Comments: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage (sometimes referred to as Solvent or Painters' Syndrome). Intentional misuse by deliberately concentrating and inhaling this material may be harmful or fatal.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders, respiratory (asthma-like) disorders.

Exposure to high concentrations of this material may increase the sensitivity of the heart to certain drugs. Persons with pre-existing heart disorders may be more susceptible to this effect (see Section 4 - Note to Physicians).

4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water. If irritation or redness develops, seek medical attention.

Inhalation (Breathing): If respiratory symptoms or other symptoms of exposure develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

Notes to Physician: Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

5. FIRE-FIGHTING MEASURES

Flammable Properties:

| | |
|----------------------------------|------------------------------|
| Flash Point: | 15°F / -9°C (TCC, ASTM D-56) |
| OSHA Flammability Class: | Flammable Liquid |
| NFPA Flammability Class: | 1B Flammable Liquid |
| LEL%: | 1.2 |
| UEL%: | 6.7 |
| Autoignition Temperature: | No data |

Unusual Fire & Explosion Hazards: This material is extremely flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Cool equipment exposed to fire with water, if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

6. ACCIDENTAL RELEASE MEASURES

Extremely flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof electrical equipment is recommended.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Use foam on spills to minimize vapors (see Section 5). Spilled material may be absorbed into an appropriate absorbent material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharge. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Wash thoroughly after handling. Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames. Use good personal hygiene practices.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconitioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with an organic vapor cartridge may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact, possible irritation, and skin damage. Examples of approved materials are nitrile, polyvinyl alcohol, or Viton® (see glove manufacturer literature for information on permeability). Depending on conditions of use, apron and/or arm covers may be necessary.

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse. It is recommended that impervious clothing be worn when skin contact is possible.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

| | |
|---|------------------------|
| Appearance: | Colorless |
| Physical Form: | Liquid |
| Odor: | Mild |
| Odor Threshold: | No data |
| pH: | Not applicable |
| Vapor Pressure (mm Hg): | 2.3 psi @ 100°F (38°C) |
| Vapor Density (air=1): | 3.50 |
| Boiling Point: | 195°F / 91°C |
| Solubility in Water: | Negligible |
| Partition Coefficient (n-octanol/water): | No data |
| Specific Gravity: | 0.693 |
| Specific Gravity Special Conditions | @ 60°F (15.6°C) |
| Bulk Density: | 5.771 |
| Bulk Density Units | lbs/gal |
| Percent Volatile: | 100% |
| Evaporation Rate (nBuAc=1): | >1 |
| Flash Point: | 15°F / -9°C |
| Test Method: | (TCC, ASTM D-56) |
| LEL%: | 1.2 |
| UEL%: | 6.7 |
| Autoignition Temperature: | No data |
| Decomposition Temperature: | No data |

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Extremely flammable liquid and vapor. Vapor can cause flash fire.

Conditions to Avoid: Avoid all possible sources of ignition (see Sections 5 and 7).

Materials to Avoid (Incompatible Materials): Avoid contact with acids and oxidizers such as chlorine and other halogens, chromates, perchlorates, peroxides and oxygen. .

Hazardous Decomposition Products: Combustion can yield carbon dioxide, carbon monoxide.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data: No definitive information available on carcinogenicity, mutagenicity, target organ, or developmental toxicity.

Acute Data:

Heptane, Branched, Cyclic and Linear - CAS: 426260-76-6

Dermal LD50 = No information available

LC50 = No information available

Oral LD50 = No information available

n-Heptane - CAS: 142-82-5

Dermal LD50 = No data available

LC50 = 18,295 ppm (2-hr., Mouse); 103 g/m³ (4-hr., Rat)

Oral LD50 = >15.0 g/kg (Mouse)

12. ECOLOGICAL INFORMATION

Not evaluated at this time.

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced, would be a RCRA "characteristic" hazardous waste due to the characteristic(s) of ignitability (D001). If the spilled or released material impacts soil, water, or other media, characteristic testing of the contaminated materials may be required prior to their disposal. Further, this material, once it becomes a waste, is subject to the land disposal restrictions in 40 CFR 268.40 and may require treatment prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent than the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT Proper Shipping Description: Heptanes, 3, UN1206, PG II

Bulk Package/Placard Marking: Display a Class 3 red-colored "FLAMMABLE" placard with a "1206" panel added.

Non-Bulk Package Labels: Display of a Class 3 red-colored "FLAMMABLE LIQUID" label is required for packages containing less than 1,001 lbs. (454 kg.).

Packaging - References (Exceptions, Non-Bulk, Bulk): 49 CFR 172.102(b)(IB2), (T4), & (TP1), 173.150, 173.202, & 173.242

Emergency Response Guide: 128

IMDG Shipping Description: Heptanes, 3, UN1206, PG II

ICAO/IATA Shipping Description: Heptanes, UN1206, Division 3, Packing Instruction 305 or 307

15. REGULATORY INFORMATION

U.S. Regulations:

EPA SARA 311/312 (Title III Hazard Categories)

| | |
|-------------------------|-----|
| Acute Health: | Yes |
| Chronic Health: | No |
| Fire Hazard: | Yes |
| Pressure Hazard: | No |
| Reactive Hazard: | No |

SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:
--None Known--

EPA (CERCLA) Reportable Quantity (in pounds):

--None Known--

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:
-- None Known --

California Proposition 65:

Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

-- None Known --

Carcinogen Identification:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

TSCA:

All components are listed on the TSCA inventory.

International Regulations:

Canadian Regulations:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Classification: B2-Flammable Liquid

WHMIS Classification: D2B-Materials causing other toxic effects - Toxic Material

16. OTHER INFORMATION

| | |
|-----------------------------|--|
| Issue Date: | 22-Dec-2004 |
| Previous Issue Date: | 11/07/2003 |
| Reason for revision: | Component review. Minor changes to Section 3 |
| MSDS Code: | 473350 |

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Material Safety Data Sheet

Version 1.0
Revision Date 04/28/2005

MSDS Number 30000007714
Print Date 07/24/2005

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Methyl Alcohol
Chemical formula : CH₄O
Synonyms : Methanol
Product Use Description : General Industrial
Company : Air Products and Chemicals, Inc
7201 Hamilton Blvd.
Allentown, PA 18195-1501
Telephone : 1-800-345-3148 Chemicals
1-800-752-1597 Gases and Electronic Chemicals
Emergency telephone number : 800-523-9374 USA
01-610-481-7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

| Components | CAS Number | Concentration (Weight) |
|----------------|------------|------------------------|
| Methyl alcohol | 67-56-1 | 90% - 100 % |

3. HAZARDS IDENTIFICATION

Emergency Overview

Keep away from heat and sources of ignition.
Components of the product may affect the nervous system.
Flammable.
Moderate respiratory irritant.
Moderate skin irritant.
Mild eye irritant.
May cause blindness.

Potential Health Effects

Inhalation : May cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure. May cause nose, throat, and lung irritation. Inhalation of vapors and/or aerosols in high concentration may cause irritation of respiratory system. Harmful if inhaled.

Eye contact : Contact with eyes may cause irritation.

Skin contact : If absorbed through the skin, may cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Causes skin irritation.

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- Ingestion : May cause central nervous system effects, such as headache, nausea, vomiting, abdominal pain, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure. May be fatal or cause blindness if swallowed.
- Chronic Health Hazard : This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater.

Exposure Guidelines

- Target Organs : Respiratory system.
Skin.
Central nervous system.
Eyes.
Blood.
- Symptoms : Repeated and/or prolonged exposure to low concentrations of vapors and/or aerosols may cause: Sore throat.

Aggravated Medical Condition

Neurological disorders Asthma. Skin disorders and Allergies.

4. FIRST AID MEASURES

- General advice : Seek medical advice. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately.
- Eye contact : Rinse immediately with plenty of water also under the eyelids for at least 20 minutes. Remove contact lenses.
- Skin contact : Wash off immediately with plenty of water for at least 20 minutes. Immediately remove contaminated clothing, and any extraneous chemical, if possible to do so without delay.
- Ingestion : Never give anything by mouth to an unconscious person. If a person vomits when lying on his back, place him in the recovery position. Medical care must emphasize the control of acidosis and the use of intravenous bicarbonate has been lifesaving. Evidence is good that treatment of methanol absorption is enhanced through the administration of ethanol, which should be given to produce a blood level of at least 0.1%. Ethanol diminishes the production of toxic metabolites of methanol. Blood methanol level of 50 mg/100mL is an indication for hemodialysis, which has improved the prognosis of methanol intoxication. Methanol is often confused with beverage alcohol (ethylalcohol). Care must be taken to prevent its ingestion, the most frequent cause of methanol poisoning. Prevent aspiration of vomit. Turn victim's head to the side.
- Inhalation : If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Move to fresh air.

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Notes to physician

Risks : In case of ingestion or massive inhalation, observe victim as an inpatient because of slow metabolism causes latent period of 24 hours between exposure and acidosis and blindness.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : Alcohol-resistant foam.
Carbon dioxide (CO₂).
Dry chemical.
Dry sand.
Limestone powder.
- Specific hazards : Incomplete combustion may form carbon monoxide. Fire or intense heat may cause violent rupture of packages. Flash back possible over considerable distance. May form explosive mixtures in air. Downwind personnel must be evacuated. Burning produces obnoxious and toxic fumes. In the event of fire, cool tanks with water spray.
- Special protective equipment for fire-fighters : Avoid contact with the skin. A face shield should be worn. Use personal protective equipment. Wear self contained breathing apparatus for fire fighting if necessary.
- Further information : Do not allow run-off from fire fighting to enter drains or water courses.

6. ACCIDENTAL RELEASE MEASURES

- Personal precautions : Use self-contained breathing apparatus and chemically protective clothing. Wear suitable protective clothing, gloves and eye/face protection. Remove all sources of ignition. Evacuate personnel to safe areas.
- Environmental precautions : Shut off or remove all ignition sources. Construct a dike to prevent spreading.
- Methods for cleaning up : Approach suspected leak areas with caution. Contact Air Products' Emergency Response Center for advice. Absorb with inert absorbent materials such as: Dry sand. Vermiculite. Activated charcoal. Place in appropriate chemical waste container.
- Additional advice : Open enclosed spaces to outside atmosphere. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

See "Flammable and Combustible Liquid Code" NFPA No. 30, National Fire Protection Association, Boston, MA. Emergency showers and eye wash stations should be readily accessible. Adhere to work practice rules established by government regulations. Avoid breathing vapors and/or aerosols. Avoid contact with eyes. Use only in well-ventilated areas. Use personal protective equipment. When using, do not eat, drink or smoke.

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Storage

To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Keep in a dry, cool place. Keep away from Oxidizers.

Technical measures/Precautions

Keep away from open flames, hot surfaces and sources of ignition.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Use explosion-proof equipment.
Provide readily accessible eye wash stations and safety showers.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal protective equipment

Respiratory protection : Wear appropriate respirator when ventilation is inadequate.

Hand protection : Neoprene gloves.
Impervious gloves.
The breakthrough time of the selected glove(s) must be greater than the intended use period.

Eye protection : Chemical safety glasses.

Skin and body protection : Long sleeve shirts and trousers without cuffs.

Environmental exposure controls : Shut off or remove all ignition sources. Construct a dike to prevent spreading.

Special instructions for protection and hygiene : Provide readily accessible eye wash stations and safety showers. Wash at the end of each workshift and before eating, smoking or using the toilet.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : Liquid.

Color : Colorless.

Odor : Characteristic. Pungent.

Molecular Weight : 32.05 g/mol

Relative vapor density : 1.11 (air = 1)

Relative density : 0.792 (water = 1)

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| | |
|--------------------------|--|
| Vapor pressure | : 97.23 mmHg |
| Density | : 49.412 lb/ft ³ (0.7915 g/cm ³) at |
| Boiling point/range | : 148 °F (64.55 °C) |
| Melting point/range | : -144 °F (-97.72 °C) |
| Flash point | : 11 °C |
| Upper flammability limit | : 36.5 %(V) |
| Lower flammability limit | : 6 %(V) |
| Water solubility | : Completely soluble. |

10. STABILITY AND REACTIVITY

| | |
|----------------------------------|--|
| Stability | : Stable under normal conditions. |
| Conditions to avoid | : Heat, flames and sparks. |
| Materials to avoid | : Reactive metals (e.g. sodium, calcium, zinc etc.). Materials reactive with hydroxyl compounds. Oxidizing agents. |
| Hazardous decomposition products | : Carbon monoxide. Carbon dioxide (CO ₂). Aldehydes. Flammable hydrocarbon fragments (e.g., acetylene). |

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

| | |
|-----------------------------------|--|
| Ingestion | : LD50 : 5,628 mg/kg Species : Rat. |
| Inhalation | : LC50 (4 h) : 83.2 mg/l Species : Rat. |
| Skin. | : LD50 : 15,800 mg/kg Species : Rabbit. |
| Eye irritation/corrosion | : Mild eye irritation. |
| Acute dermal irritation/corrosion | : Skin irritation. |

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Chronic Health Hazard

Methanol has relatively low acute toxicity in non-primates, but causes profound species-specific toxicity dependent on the extent to which formate accumulates. Sensitive primate species develop increased blood formate concentrations after methanol exposure, while rodents, rabbits and dogs do not. Exposure of non-primate lab animals to high methanol doses result in Central Nervous System (CNS) depression. Toxic effects in primates including metabolic acidosis and ocular toxicity, effects not normally found in lower animals.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity : EC50 (48 h) : 13,200 mg/l
Species : Rainbow trout (*Oncorhynchus mykiss*).
EC50 (48 h) : 16,000 mg/l
Species : Bluegill sunfish (*Lepomis macrochirus*).
EC50 (48 h) : > 10,000 mg/l
Species : Daphnia

Toxicity to other organisms : No data available.

Persistence and degradability

Mobility : No data available.

Bioaccumulation : Negligible bioaccumulation potential.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : Contact supplier if guidance is required.

Contaminated packaging : Dispose of container and unused contents in accordance with federal, state, and local requirements.

14. TRANSPORT INFORMATION

CFR

Proper shipping name : Methanol
Class : 3
UN/ID No. : UN1230
Packing group : II

IATA

Proper shipping name : Methanol
Class : 3 (6.1)
UN/ID No. : UN1230
Packing group : II

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Revision Date 04/28/2005

MSDS Number 30000007714
Print Date 07/24/2005

IMDG

Proper shipping name : METHANOL
Class : 3 (6.1)
UN/ID No. : UN1230
Packing group : II

CTC

Proper shipping name : METHANOL
Class : 3 (6.1)
UN/ID No. : UN1230
Packing group : II

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Flammable. Irritant. Other short term hazards.

| Country | Regulatory list | Notification |
|-------------|-----------------|--|
| USA | TSCA | Included on Inventory. |
| EU | EINECS | Included on EINECS inventory or polymer substance, monomers included on EINECS inventory or no longer polymer. |
| Canada | DSL | Included on Inventory. |
| Australia | AICS | Included on Inventory. |
| Japan | ENCS | Included on Inventory. |
| South Korea | ECL | Included on Inventory. |
| China | SEPA | Included on Inventory. |
| Philippines | PICCS | Included on Inventory. |

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Fire Hazard. Acute Health Hazard

EPA SARA Title III Section 313 (40 CFR 372) Component(s) above 'de minimus' level:
Methyl alcohol

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)
This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

16. OTHER INFORMATION

HMIS Rating

Health : 4
Flammability : 3
Physical hazard : 0

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

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Print Date 07/24/2005

For additional information, please visit our Product Stewardship web site at
<http://www.airproducts.com/productstewardship/>

| | |
|---|---|
| MSDS Material Safety Data Sheet | 24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300 |
| | National Response in Canada CANUTEC: 613-996-6666 |
| From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865 | Outside U.S. and Canada Chemtrec: 703-527-3887 |
|   | NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals. |
| All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance. | |

NAPHTHALENE

1. Product Identification

Synonyms: Naphthene; mothballs; tar camphor; naphthaliin; white-tar
CAS No. : 91-20-3
Molecular Weight: 128.16
Chemical Formula: C10H8
Product Codes:
J. T. Baker: 2718
Mallinckrodt: 6348

2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|-------------|---------|-----------|-----------|
| Naphthalene | 91-20-3 | 90 - 100% | Yes |

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION. MAY AFFECT LIVER, KIDNEY, BLOOD AND CENTRAL NERVOUS SYSTEM. COMBUSTIBLE.

J. T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 2 - Moderate
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation of dust or vapors can cause headache, nausea, vomiting, extensive sweating, and disorientation. The predominant reaction is delayed intravascular hemolysis with symptoms of anemia, fever, jaundice, and kidney or liver damage.

Ingestion:

Toxic. Can cause headache, profuse perspiration, listlessness, dark urine, nausea, vomiting and disorientation. Intravascular hemolysis may also occur with symptoms similar to those noted for inhalation. Severe cases may produce coma with or without convulsions. Death may result from renal failure.

Skin Contact:

Can irritate the skin and, on prolonged contact, may cause rashes and allergy. "Sensitized" individuals may suffer a severe dermatitis.

Eye Contact:

Vapors and solid causes irritation, redness and pain. Very high exposures can damage the nerves of the eye.

Chronic Exposure:

Has led to cataract formation in eyes. May cause skin allergy.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin, blood or vascular disorders or impaired respiratory function may be more susceptible to the effects of the substance. Particularly susceptible individuals are found in the general population, most commonly in dark skinned races.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 87C (189F) CC

Autoignition temperature: 526C (979F)

Combustible. May be ignited by heat, sparks or flame. May burn rapidly with flare-burning effect. Fire may produce irritating or poisonous gases.

Explosion:

Explosive limits, volume % in air: lel: 0.9; uel: 5.9. Above flashpoint, vapor-air mixtures are explosive within flammable limits noted above. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire or explosion.

Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide. Foam or direct water spray on molten naphthalene may cause extensive foaming. Molten naphthalene spatters in contact with water; apply water from as far a distance as possible.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back.

6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Keep away from moisture and oxidizers. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL):
10 ppm, 50 mg/m3.

- ACGIH Threshold Limit Value (TLV):

TWA= 10 ppm, 52 mg/m3

STEL= 15 ppm, 79 mg/m3.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face respirator with an organic vapor cartridge and particulate filter (NIOSH type P95 or R95 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with an organic vapor cartridge and particulate filter (NIOSH P100 or R100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White crystals.

Odor:

Strong coal tar odor (moth balls).

Solubility:

Insoluble in water.

Specific Gravity:

1.2

pH:

No information found.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

218C (424F)

Melting Point:

80C (176F)

Vapor Density (Air=1):

4.4

Vapor Pressure (mm Hg):

1 @ 53C (127F)

Evaporation Rate (BuAc=1):

< 1

10. Stability and Reactivity

Stability:

Stable at room temperature in sealed containers. Sublimes appreciably at temperatures above melting point.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizers, strong alkalis and strong mineral acids, mixtures of aluminum trichloride and benzoyl chloride. Reacts violently with chromic anhydride. Melted naphthalene will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:

Avoid heat, sparks, flames and other ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 490 mg/kg;

Inhalation rat LC50: 340 mg/m3, 1 hour;

Skin rabbit LD50: > 20 g/kg;

Irritation data: skin (open Draize) rabbit 495 mg, mild; eye (standard Draize) rabbit 100 mg, mild;

Investigated as a tumorigen, mutagen and reproductive effector.

| Ingredient | ---NTP Carcinogen--- | | IARC Category |
|-----------------------|----------------------|-------------|---------------|
| | Known | Anticipated | |
| Naphthalene (91-20-3) | No | No | None |

12. Ecological Information

Environmental Fate:

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material may bioaccumulate to some extent. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NAPHTHALENE, REFINED

Hazard Class: 4.1

UN/NA: UN1334

Packing Group: III

Information reported for product/size: 1KG

International (Water, I.M.O.)

Proper Shipping Name: NAPHTHALENE, REFINED

Hazard Class: 4.1

UN/NA: UN1334

Packing Group: III

Information reported for product/size: 1KG

International (Air, I.C.A.O.)

Proper Shipping Name: NAPHTHALENE, REFINED

Hazard Class: 4.1

UN/NA: UN1334

Packing Group: III

Information reported for product/size: 1KG

15. Regulatory Information

| -----\Chemical Inventory Status - Part 1\----- | | | | |
|--|------|-----|-------|-----------|
| Ingredient | TSCA | EC | Japan | Australia |
| Naphthalene (91-20-3) | Yes | Yes | Yes | Yes |

| -----\Chemical Inventory Status - Part 2\----- | | | | |
|--|-------|------------|------|-------|
| Ingredient | Korea | --Canada-- | | |
| | | DSL | NDSL | Phil. |
| Naphthalene (91-20-3) | Yes | Yes | No | Yes |

| -----\Federal, State & International Regulations - Part 1\----- | | | | |
|---|------------|-----|------------|----------------|
| Ingredient | -SARA 302- | | -SARA 313- | |
| | RQ | TPQ | List | Chemical Catg. |
| Naphthalene (91-20-3) | No | No | Yes | No |

| -----\Federal, State & International Regulations - Part 2\----- | | | |
|---|--------|--------|----------------|
| Ingredient | CERCLA | -RCRA- | |
| | | 261.33 | -TSCA- 8(d) |
| Naphthalene (91-20-3) | 100 | U165 | No |

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: 2Z
Poison Schedule: S6
WHMIS:

16. Other Information

NFPA Ratings: Health: **2** Flammability: **2** Reactivity: **0**

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION. MAY AFFECT LIVER, KIDNEY, BLOOD AND CENTRAL NERVOUS SYSTEM. COMBUSTIBLE.

Label Precautions:

Avoid contact with eyes, skin and clothing.
Avoid prolonged or repeated contact with skin.
Avoid breathing dust.
Avoid breathing vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat, sparks and flame.

Label First Aid:

In all cases call a physician. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person.

Product Use:

Laboratory Reagent.

Revision Information:

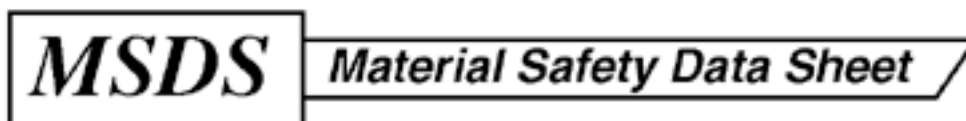
No Changes.

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **P6390** * * * * * *Effective Date: 08/31/07*
* * * * * *Supersedes: 02/04/05*



From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



Mallinckrodt
CHEMICALS



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All non-emergency questions should be directed to Customer Service (1-800-5

N-PROPYL ALCOHOL

1. Product Identification

Synonyms: 1-Propanol; Ethyl Carbinol;

1-Hydroxypropane; n-Propanol

CAS No.: 71-23-8

Molecular Weight: 60.1

Chemical Formula: CH₃(CH₂)₂ OH

Product Codes:

J.T. Baker: 9030, 9031, 9086, 9087, 9099

Mallinckrodt: 5351, 5919, 7169

2. Composition/Information on Ingredients

| Ingredient | CAS No | P |
|----------------|---------|---|
| ----- | ----- | - |
| Propyl Alcohol | 71-23-8 | |

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. ASPIRATION MAY CAUSE LUNG DAMAGE.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 2 - Moderate
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD;

LAB COAT & APRON; VENT HOOD;
PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Vapors have a mild narcotic effect and act as an upper respiratory tract irritant. Symptoms may include irritation of the eyes, nose, and throat, drowsiness, headache, and incoordination.

Excessive exposures may lead to narcosis and central nervous system depression.

Ingestion:

Aspiration into the lungs may occur during swallowing or vomiting, resulting in lung damage. May cause nausea, vomiting, drowsiness, gastrointestinal pain, cramps and diarrhea. Large doses may cause death.

Skin Contact:

Defatting agent. May cause skin irritation. Skin absorption may occur with symptoms paralleling those from inhalation exposure.

Eye Contact:

Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain. May cause corneal injury or blindness.

Chronic Exposure:

Prolonged or repeated skin contact may cause dermatitis. No systemic chronic effects have been reported in humans.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin problems or

impaired respiratory function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Aspiration hazard. Do NOT induce vomiting. Give large amounts of water. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Treat CNS depression supportively. Rule out other causes. Treat ingestion with gastric lavage and saline catharsis. Metabolite acetone may be detected in urine.

5. Fire Fighting Measures

Fire:

Flash point: 23C (73F) CC

Autoignition temperature: 412C (774F)

Flammable limits in air % by volume:

lcl: 2.3; ucl: 13.7

Flammable Liquid and Vapor!

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Vapors can flow along surfaces to distant ignition source and flash back. Ignites on contact with potassium tertbutoxide.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal

protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Water can be used to dilute to raise flashpoint and to flush away from possible sources of ignition.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA), 250 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):
200 ppm (TWA), 400 ppm (STEL), A3 -
Confirmed animal carcinogen with unknown
relevance to humans

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with organic vapor cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING: Air**

purifying respirators do not protect workers in oxygen-deficient atmospheres. This compound possibly exists in both particulate and vapor phase. A particulate (NIOSH type N95 or better) prefilter should be used for the particulate.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Alcohol odor.

Solubility:

Infinitely soluble.

Specific Gravity:

0.804

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

97C (207F)

Melting Point:

-127C (-197F)

Vapor Density (Air=1):

2.07

Vapor Pressure (mm Hg):

21 @ 25C (77F)

Evaporation Rate (BuAc=1):

1.3

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition. May produce acrid smoke and irritating fumes when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong acids, aldehydes, halides, halogens, Reacts violently with potassium-tert-butoxide. Can react vigorously with oxidizing materials.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral Rat LD50: 1870 mg/kg; Skin Rabbit

LD50: 4060 mg/kg; Inhalation mouse LC50:
 48 mg/m³; Irritation, open, eye rabbit 4mg,
 Severe; open, skin, rabbit: 580 mg/24 Hr.
 Mild; Investigated as a tumorigen, a mutagen,
 and a reproductive effector.

| -----\Cancer Lists\----- | | |
|--------------------------|-----------------|----------------------------|
| Ingredient | ---NTP Known | Carcinogen-- Anticipate |
| Propyl Alcohol (71-23-8) | No | No |

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity:

The LC50/96-hour values for fish are between 1 and 10 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: N-PROPANOL

Hazard Class: 3

UN/NA: UN1274

Packing Group: III

Information reported for product/size: 370LB

International (Water, I.M.O.)

Proper Shipping Name: N-PROPANOL

Hazard Class: 3
UN/NA: UN1274
Packing Group: III
Information reported for product/size: 370LB

15. Regulatory Information

```
-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC
-----
Propyl Alcohol (71-23-8)                       Yes   Yes
```

```
-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DS
-----
Propyl Alcohol (71-23-8)                       Yes   Ye
```

```
-----\Federal, State & International Regulations - Part
-SARA 302-   -
Ingredient   RQ   TPQ   L
-----
Propyl Alcohol (71-23-8)   No   No   N
```

```
-----\Federal, State & International Regulations - Part
-RCR
Ingredient   CERCLA   261.
-----
Propyl Alcohol (71-23-8)   No   No
```

Chemical Weapons Convention: No TSCA 12(b): No CDT
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Press
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[S]E
Poison Schedule: None allocated.
WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

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

Label Hazard Warning:

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. ASPIRATION MAY CAUSE LUNG DAMAGE.

Label Precautions:

Keep away from heat, sparks and flame.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult,

give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water.

Never give anything by mouth to an unconscious person. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 4, 10, 16.

Disclaimer:

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**RESULTING FROM USE OF OR
RELIANCE UPON THIS INFORMATION.**

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

J T BAKER -- PARAFFIN OIL, 9388
MATERIAL SAFETY DATA SHEET
NSN: 681000N036766
Manufacturer's CAGE: 70829
Part No. Indicator: A
Part Number/Trade Name: PARAFFIN OIL, 9388

=====
General Information
=====

Company's Name: J T BAKER INC
Company's Street: 222 RED SCHOOL LANE
Company's City: PHILLIPSBURG
Company's State: NJ
Company's Country: US
Company's Zip Code: 08865-2219
Company's Emerg Ph #: 908-859-2151;800-424-9300(CHEMTREC)
Company's Info Ph #: 800-582-2537
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 09MAR92
Safety Data Review Date: 16NOV92
MSDS Serial Number: BQRJL
Hazard Characteristic Code: N1

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: MINERAL OIL (EXPOSURE REGULATED AS 'OIL MIST')
Ingredient Sequence Number: 01
Percent: 90-100
NIOSH (RTECS) Number: PY8030000
CAS Number: 8012-95-1
OSHA PEL: 5 MG/M3
ACGIH TLV: 5 MG/M3;10 STEL

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: CLEAR, COLORLESS VISCOUS LIQUID; ODORLESS.
Boiling Point: N/A
Melting Point: -0F,-18C
Vapor Pressure (MM Hg/70 F): <0.5 @ 20C
Vapor Density (Air=1): N/A
Specific Gravity: 0.88 (H*20=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NEGLIGIBLE (<0.1%)
Percent Volatiles By Volume: 0
pH: N/A

=====
Fire and Explosion Hazard Data
=====

Flash Point: 419F,215C
Flash Point Method: CC
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.

(WATER MAY BE INEFFECTIVE).
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). MOVE CNTNRS FROM FIRE AREA IF IT CAN BE DONE W/OUT RISK. USE WATER TO KEEP FIRE-EXPOSED CNTNRS COOL.
Unusual Fire And Expl Hazrds: NONE IDENTIFIED.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): HEAT, FLAME.
Materials To Avoid: STRONG OXIDIZING AGENTS, CHLORINE.
Hazardous Decomp Products: CARBON MONOXIDE, CARBON DIOXIDE.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT
=====

=====
Health Hazard Data
=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE:INHAL:IRRITATION OF MUCOUS MEMBRANES, HEADACHE, NAUSEA, VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY TRACT, UNCONSCIOUSNESS. SKIN:PROLONGED CONTACT MAY CAUSE IRRITATION. EYE:IRRITATION. INGEST:NAUSEA, VOMITING, DIARRHEA. TARGET ORGANS:RESPIRATORY SYSTEM, LUNGS, SKIN. (EFTS OF OVEREXP)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: HLTH HAZ:CHRONIC:NONE IDENTIFIED.
Med Cond Aggravated By Exp: NONE IDENTIFIED.
Emergency/First Aid Proc: INGEST:IF SWALLOWED & PERSON IS CONSCIOUS, IMMEDIATELY GIVE LG AMTS OF WATER. GET MED ATTN. INHAL:MOVE EXPOSED PERSON TO FRESH AIR. SKIN:IMMEDIATELY WASH W/PLENTY OF SOAP & WATER FOR @ LST 15 MINS. EYE: IMMEDIATELY FLUSH W/PLENTY OF WATER FOR @ LST 15 MINUTES.
=====

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: WEAR SUITABLE PROTECTIVE CLOTHING. TAKE UP W/SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL & PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH SPILL AREA W/WATER.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE I/A/W ALL APPLICABLE FEDERAL, STATE & LOCAL ENVIRONMENTAL REGULATIONS.
Precautions-Handling/Storing: KEEP CNTNR TIGHTLY CLSD. SUITABLE FOR ANY GEN CHEM STORAGE AREA. DO NOT STORE NEAR OXIDIZING MATERIALS. PRODUCT MAY SOLIDIFY AT ROOM TEMPERATURE.
Other Precautions: AVOID CONTACT W/EYES, SKIN OR CLOTHING. AVOID BREATHING VAPOR. USE W/ADEQUATE VENTILATION.
=====

=====
Control Measures
=====

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATORY PROT REQUIRED IF AIRBORNE CONC EXCEEDS TLV. AT CONCS UP TO 250 MG/M3, A HIGH-EFFICIENCY PARTICULATE RESP IS RECOM. ABOVE THIS LEVEL, A SCBA IS ADVISED.
Ventilation: USE GENERAL OR LOCAL EXHAUST VENT TO MEET TLV REQUIREMENTS.

Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

=====
Transportation Data
=====

Trans Data Review Date: 93159
DOT PSN Code: ZZZ
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI PSN Code: ZZZ
AFI Prop. Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
Additional Trans Data: NOT REGULATED FOR TRANSPORTATION
=====

Disposal Data
=====

Label Data
=====

Label Required: YES
Technical Review Date: 16NOV92
Label Date: 13NOV92
Label Status: G
Common Name: PARAFFIN OIL, 9388
Chronic Hazard: NO
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-Slight: X
Reactivity Hazard-Slight: X
INHALATION MAY CAUSE IRRITATION OF MUCOUS MEMBRANES, HEADACHE, NAUSEA,
VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY TRACT,
UNCONSCIOUSNESS. CONTACT MAY CAUSE SKIN OR EYE IRRITATION. INGESTION MAY
CAUSE NAUSEA, VOMITING, DIARRHEA. CHRONIC:NONE SPECIFIED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: J T BAKER INC
Label Street: 222 RED SCHOOL LANE
Label City: PHILLIPSBURG
Label State: NJ
Label Zip Code: 08865-2219
Label Country: US
Label Emergency Number: 908-859-2151;800-424-9300(CHEMTREC)



MATERIAL SAFETY DATA SHEET

MSDS No. M0001

Effective Date: 02/11/2002

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Group: REFRACTORY CERAMIC FIBER PRODUCT
Chemical Name: VITREOUS ALUMINOSILICATE FIBER
Synonym(s): RCF, ceramic fiber, synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF)
Trade Names: **FIBERFRAX® CERAMIC FIBER PRODUCTS , INCLUDES:**
FIBERS
FIBERFRAX® HIGH PURITY FIBERS: HP-ODB; Module Trim; MT-HP; HP-Chopped; H Bulk; Regular Bulk, Spun Bulk.
FIBERFRAX® 6000 SERIES FIBERS: All bulk fibers from 6000-AAA to 6100-ZZZ, 6900-70A to 6900-99Z.
FIBERFRAX® 7000 SERIES FIBERS: 7000-AA to 7100-ZZ.
FIBERFRAX® MILLED FIBERS: EF-119; HP Ball Milled A; HP Ball Milled B; HP Ball Milled C/D.
FIBERFRAX® HIGH INDEX FIBERS: W-657; W-707; W-758; HS-95C; MX-135-CW; MX-400-CW; HS-70; HS-70C.
FIBERFRAX® HSA™ FIBERS: HSA-K; HSA-HP.
FIBERFRAX® KAOLIN FIBERS: K-Chopped; KMTX; MT; MTX; MT-T; MX-150.

BLANKETS
Durablanket® AC; Durablanket® HP; Durablanket® HP-S; Durablanket® S; Durablanket® FIBERMAT®; LO-CON™ BLANKET

PAPERS
FIBERFRAX® BINDERLESS PAPERS: 972-AH; 972-FH; 972-JH; 882-FH; 882-JH; HSA-F without binder; HSA-J without binder.

Manufacturer/Supplier: Unifrax Corporation
2351 Whirlpool St.
Niagara Falls, NY 14305-2413

Product Stewardship Information Hotline
1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

For additional MSDSs, visit our web page, <http://www.unifrax.com>, or call Unifrax Customer Service at (716) 278-3872

CHEMTREC Assist: CHEMTREC will provide assistance for chemical emergencies. Call 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

| <u>COMPONENTS</u> | <u>CAS NUMBER</u> | <u>% BY WEIGHT</u> |
|---------------------------------------|-------------------|--------------------|
| Refractories, Fibers, Aluminosilicate | 142844-00-6 | 100 |

(See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING!
POSSIBLE CANCER HAZARD BY INHALATION.
(See Section 11 for more information)

CHRONIC EFFECT

There has been no increased incidence of respiratory disease in studies examining occupationally exposed workers. In animal studies, long-term laboratory exposure to doses hundreds of times higher than normal occupational exposures has produced fibrosis, lung cancer, and mesothelioma in rats or hamsters. The fibers used in those studies were specially sized to maximize rodent respirability.

OTHER POTENTIAL EFFECTS

TARGET ORGANS:

Respiratory Tract (nose & throat), Eyes, Skin

RESPIRATORY TRACT (nose & throat) IRRITATION:

If inhaled in sufficient quantity, may cause temporary, mild mechanical irritation to respiratory tract. Symptoms may include scratchiness of the nose or throat, cough or chest discomfort.

EYE IRRITATION:

May cause temporary, mild mechanical irritation. Fibers may be abrasive; prolonged contact may cause damage to the outer surface of the eye.

SKIN IRRITATION:

May cause temporary, mild mechanical irritation. Exposure may also result in inflammation, rash or itching.

GASTROINTESTINAL IRRITATION:

Unlikely route of exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Pre-existing medical conditions, including dermatitis, asthma or chronic lung disease may be aggravated by exposure; individuals who have a history of allergies may experience greater amounts of skin and respiratory irritation.

HAZARD CLASSIFICATION

Although studies, involving occupationally exposed workers, have not identified any increased incidence of respiratory disease, results from animal testing have been used as the basis for hazard classification. In each of the following cases, the conclusions are qualitative only and do not rest upon any quantitative analysis suggesting that the hazard actually may occur at current occupational exposure levels.

In October 2001, the **International Agency for Research on Cancer (IARC)** confirmed that Group 2b (possible human carcinogen) remains the appropriate IARC classification for RCF.

The Seventh Annual Report on Carcinogens (1994), prepared by the **National Toxicology Program (NTP)**, classified respirable RCF and glasswool as substances reasonably anticipated to be carcinogens.

The **American Conference of Governmental Industrial Hygienist**

Human Carcinogen.”

The **Commission of The European Communities (DG XI)** has classified RCF as a substance that should be regarded as if it is carcinogenic to man.

The **State of California**, pursuant to Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986, has listed "ceramic fibers (airborne fibers of respirable size)" as a chemical known to the State of California to cause cancer.

The **Canadian Environmental Protection Agency (CEPA)** has classified RCF as "probably carcinogenic" (Group 2).

The **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A – Materials Causing Other Toxic Effects

The **Hazardous Materials Identification System (HMIS)** –

Health 1* Flammability 0 Reactivity 0 Personal Protection Index: X (Employer Determined)

(* denotes potential for chronic effects)

4. FIRST AID MEASURES

FIRST AID PROCEDURES

RESPIRATORY TRACT (nose & throat) IRRITATION:

If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

EYE IRRITATION:

If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

SKIN IRRITATION:

If skin becomes irritated, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:

If gastrointestinal tract irritation develops, move the person to a dust free environment.

NOTES TO PHYSICIANS:

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

NFPA Codes: **Flammability:** 0 **Health:** 1 **Reactivity:** 0 **Special:** 0

NFPA Unusual Hazards:

None

Flammable Properties:

None

Flash Point:

None

Hazardous Decomposition Products:

None

Unusual Fire and Explosion Hazard:

None

Extinguishing Media:

Use extinguishing media suitable for type of surrounding fire.

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES

Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum must be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

7. HANDLING AND STORAGE

STORAGE

Store in original container in a dry area. Keep container closed when not in use.

HANDLING

Handle ceramic fiber carefully. Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE GUIDELINES

| COMPONENTS | OSHA PEL | MANUFACTURER REG |
|---------------------------------------|-------------------|-----------------------|
| Refractories, Fibers, Aluminosilicate | None Established* | 0.5 f/cc, 8-hr. TWA** |

* There is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally; Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

** The Refractory Ceramic Fibers Coalition (RCFC) has sponsored comprehensive toxicology and epidemiology studies to identify potential RCF-related health effects [see Section 11 for more details], consulted experts familiar with fiber and particle science, conducted a thorough review of the RCF-related scientific literature, and further evaluated the data in a state-of-the-art quantitative risk assessment. Based on these efforts and in the absence of an OSHA PEL, RCFC has adopted a recommended exposure guideline, as measured under NIOSH Method 7400 B. The manufacturers' REG is intended to promote occupational health and safety through prudent exposure control and reduction and it reflects relative technical and economic feasibility as determined by extensive industrial hygiene monitoring efforts undertaken pursuant to an agreement with the U.S. Environmental Protection Agency.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: Australia – 0.5 f/cc; Austria – 0.5 f/cc; Canada – 0.5 to 1.0 f/cc; Denmark – 1.0 f/cc; France – 0.6 f/cc; Germany – 0.5 f/cc; Netherlands – 1.0 f/cc; New Zealand – 1.0 f/cc; Norway – 2.0 f/cc; Poland – 2.0 f/cc; Sweden – 1.0 f/cc; United Kingdom – 2.0 f/cc. Non-regulatory OEL examples include: ACGIH TLV 0.2 f/cc; RCFC REG 0.5 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is t

qualified Industrial Hygienist.

ENGINEERING CONTROLS

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

PERSONAL PROTECTION EQUIPMENT

Respiratory Protection – RCF:

When engineering and/or administrative controls are insufficient to maintain workplace concentrations within the 0.5 f/cc REG, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The following information is provided as an example of appropriate respiratory protection for aluminosilicate fibers. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

| MANUFACTURER’S RESPIRATORY PROTECTION RECOMMENDATIONS WHEN HANDLING RCF PRODUCTS | |
|--|--|
| <u>Respirable Airborne Fiber Concentration</u> (levels are 8-hr. time-weighted averages) | <u>Respirator Recommendation</u> [†] |
| Not yet determined but expected to be below 5.0 f/cc based on operation | Half-face, air purifying respirator equipped with a NIOSH certified P100 particulate filter cartridge |
| "Reliably" less than 0.5 f/cc | Optional |
| 0.5 f/cc to 5.0 f/cc | Half-face, air purifying respirator equipped with a NIOSH certified P100 particulate filter cartridge |
| 5.0 f/cc to 25 f/cc | Full-facepiece, air purifying respirator equipped with a NIOSH certified P100 particulate filter cartridge or PAPR |
| Greater than 25 f/cc | PAPR with tight-fitting full facepiece or a supplied air respirator in continuous flow mode |
| When individual workers request respiratory protection as a matter of personal comfort or choice where exposures are "reliably" below 0.5 f/cc | A NIOSH certified respirator, such as a disposable particulate respirator, or respirators with filter cartridges rated N95 or better |

[†]The P100 recommendation is a conservative default choice; in some case, solid arguments can be made that other respirator types (e.g., N95, R99, etc.) may be suitable for some tasks or work environments. The P100 recommendation is not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

Other Information:

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica. If exposure levels are known, the respiratory protection chart provided above may be applied.
- Potential exposure to other airborne contaminants should be evaluated by a qualified Industrial Hygienist for the selection of appropriate respiratory protection and air monitoring

Skin Protection:

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---------------------------------|-----------------------------------|
| ODOR AND APPEARANCE: | White, odorless, fibrous material |
| CHEMICAL FAMILY: | Vitreous Aluminosilicate Fibers |
| BOILING POINT: | Not Applicable |
| WATER SOLUBILITY (%): | Not Soluble in Water |
| MELTING POINT: | 1760° C (3200° F) |
| SPECIFIC GRAVITY: | 2.50 – 2.75 |
| VAPOR PRESSURE: | Not Applicable |
| pH: | Not Applicable |
| VAPOR DENSITY (Air = 1): | Not Applicable |
| % VOLATILE: | Not Applicable |
| MOLECULAR FORMULA: | Not Applicable |

10. STABILITY AND REACTIVITY

| | |
|--|--|
| CHEMICAL STABILITY: | Stable under conditions of normal use. |
| INCOMPATIBILITY: | |
| CONDITIONS TO AVOID: | None. |
| HAZARDOUS DECOMPOSITION PRODUCTS: | None. |
| HAZARDOUS POLYMERIZATION: | Not Applicable. |

11. TOXICOLOGICAL INFORMATION

HEALTH DATA SUMMARY

Epidemiological studies of RCF production workers have indicated no increased incidence of respiratory disease nor other significant health effects. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

EPIDEMIOLOGY

The University of Cincinnati is conducting an ongoing epidemiologic investigation. The evidence obtained from employees in U. S. RCF manufacturing facilities is as follows:

- 1) There is no evidence of any fibrotic lung disease (interstitial fibrosis)

2) There is no evidence of an elevated incidence of lung disease among RCF manufacturing employees.

3) In early studies, an apparent statistical “trend” was observed, in the exposed population, between RCF exposure duration and some measures of lung function. The observations were clinically insignificant. If these observations were made on an individual employee, the results would be interpreted as being within the normal (predicted) respiratory range. A more recent longitudinal study of employees with 5 or more pulmonary function tests found that there was no effect on lung function associated with RCF production experience. Initial data (circa 1987) seemed to indicate an interactive effect between smoking and RCF exposure; more recent data, however, found no interactive effect. Nevertheless, to promote good health, RCF employees are still actively encouraged not to smoke.

4) Pleural plaques (thickening along the chest wall) have been observed in a small number of RCF employees. Some studies appear to show a relationship between the occurrence of pleural plaques on chest radiographs and the following variables: (a) years since RCF production hire date; (b) duration of RCF production employment; and (c) cumulative RCF exposure. The best evidence to date indicates that pleural plaques are a marker of exposure only. Pleural plaques are not associated with pulmonary impairment. The pathogenesis of pleural plaques remains incompletely understood; however, the mechanism appears to be an inflammatory response caused by inhaled fibers.

TOXICOLOGY

A number of toxicological studies designed to identify any potential health effects from RCF exposure have been completed. In one study, conducted by the Research and Consulting Company, (Geneva, Switzerland), rats and hamsters were exposed to 30 mg/m³ (about 200 fibers/cc) of specially-prepared RCF for 6 hours/day, 5 days/week, for up to 24 months. In rats, a statistically significant increase in lung tumors was observed; two mesotheliomas (cancer of the pleural lining between the chest wall and lung) were also identified. Hamsters did not develop lung tumors; however, interstitial fibrosis and mesothelioma was found. Some, in the scientific community, have concluded that the “maximum tolerated dose” was exceeded and that significant particle contamination was a confounding issue; therefore, these study findings may not represent an accurate assessment of the potential for RCF to produce adverse health effects.

In a related multi-dose study with a similar protocol, other rats were exposed to doses of 16 mg/m³, 9 mg/m³, 3 mg/m³ which corresponds to about 115, 75, and 25 fibers per cubic centimeter respectively. This study found no statistically significant increase in lung cancer. Some cases of pleural and parenchymal fibrosis were seen in the 16 mg/m³ dose group. Some cases of mild fibrosis and one mesothelioma were observed in the 9 mg/m³ group. No acute respiratory effects were seen in the rats in the 3 mg/m³ exposure group, which suggests that there may be a dose/response threshold, below which irreversible respiratory impacts do not occur.

Other toxicological studies have been conducted which utilized non-physiological exposure methods such as intrapleural, intraperitoneal and intratracheal implantation or injection. Some of these studies have found that RCF is a potential carcinogen. Some experts, however, suggest that these tests have limited relevance because they bypass many of the biological mechanisms that prevent fiber deposition or facilitate fiber clearance.

To obtain more epidemiology or toxicology information, please call the toll free telephone number for the Unifrax

12. ECOLOGICAL INFORMATION

No ecological concerns have been identified.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

RCF, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

| | | | |
|---------------|----------------|-----------------------------|----------------|
| Hazard Class: | Not Regulated | United Nations (UN) Number: | Not Applicable |
| Labels: | Not Applicable | North America (NA) Number: | Not Applicable |
| Placards: | Not Applicable | Bill of Lading: | Product Name |

INTERNATIONAL

Canadian TDG Hazard Class & PIN: Not regulated

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

- EPA:** **Superfund Amendments and Reauthorization Act (SARA)** Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).
Toxic Substances Control Act (TSCA) - All substances in this product are listed, as required, on the TSCA inventory. RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. The components of RCF are listed on the inventory.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** - RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.
- OSHA:** Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.
- California:** Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.
- Other States:** RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada: **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A – Materials Causing Other Toxic Effects
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

European Union: **European Directive 97/69/EC** classified RCF as a Category 2 carcinogen; that is it “should be regarded as if it is carcinogenic to man.”

16. OTHER INFORMATION

RCF DEVITRIFICATION

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline silica (cristobalite) formation may begin at temperatures of approximately 1200° C (2192° F). The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied" (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 g/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 g/cm²).

RCF AFTER-SERVICE REMOVAL

Respiratory protection should be provided in compliance with OSHA standards. During removal operations, a full face respirator is recommended to reduce inhalation exposure along with eye and respiratory tract irritation. A specific evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified industrial hygiene professional.

PRODUCT STEWARDSHIP PROGRAM

The Unifrax Corporation has established a program to provide customers with up-to-date information regarding the proper use and handling of refractory ceramic fiber. In addition, Unifrax Corporation has also established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Unifrax Corporation Product Stewardship Information Hotline at 1-800-322-2293.

On February 11, 2002, the Refractory Ceramic Fibers Coalition (RCFC) and the U.S. Occupational Safety and Health Administration (OSHA) introduced a voluntary worker protection program entitled PSP 2002, a comprehensive, multi-faceted risk management program designed to control and reduce workplace exposures to refractory ceramic fiber (RCF). Unifrax Corporation, as a member of RCFC, is participating in this highly acclaimed product stewardship program. For more information regarding PSP 2002, please call the Unifrax Corporation's Product Stewardship Information Hotline at 1-800-322-2293 or refer to the RCFC web site: <http://www.rcfc.net>.

DEFINITIONS

| | |
|--|--|
| ACGIH: | American Conference of Governmental Industrial Hygienists |
| ADR: | Carriage of Dangerous Goods by Road (International Regulation) |
| CAA: | Clean Air Act |
| CAS: | Chemical Abstracts Service |
| CERCLA: | Comprehensive Environmental Response, Compensation and Liability Act |
| DSL: | Domestic Substances List |
| EPA: | Environmental Protection Agency |
| EU: | European Union |
| f/cc: | Fibers per cubic centimeter |
| HEPA: | High Efficiency Particulate Air |
| HMIS: | Hazardous Materials Identification System |
| IARC: | International Agency for Research on Cancer |
| IATA: | International Air Transport Association |
| IMDG: | International Maritime Dangerous Goods Code |
| mg/m³: | Milligrams per cubic meter of air |
| mmpcf: | Million particles per cubic meter |
| NFPA: | National Fire Protection Association |
| NIOSH: | National Institute for Occupational Safety and Health |
| OSHA: | Occupational Safety and Health Administration |
| 29 CFR 1910.134 & 1926.103: | OSHA Respiratory Protection Standards |
| 29 CFR 1910.1200 & 1926.59: | OSHA Hazard Communication Standards |
| PEL: | Permissible Exposure Limit (OSHA) |
| PIN: | Product Identification Number |
| PNOC: | Particulates Not Otherwise Classified |
| PNOR: | Particulates Not Otherwise Regulated |
| PSP: | Product Stewardship Program |
| RCFC: | Refractory Ceramic Fibers Coalition |
| RCRA: | Resource Conservation and Recovery Act |
| REG: | Recommended Exposure Guideline (RCFC) |
| REL: | Recommended Exposure Limit (NIOSH) |
| RID: | Carriage of Dangerous Goods by Rail (International Regulations) |
| SARA: | Superfund Amendments and Reauthorization Act |
| SARA Title III: | Emergency Planning and Community Right to Know Act |
| SARA Section 302: | Extremely Hazardous Substances |
| SARA Section 304: | Emergency Release |
| SARA Section 311: | MSDS/List of Chemicals and Hazardous Inventory |
| SARA Section 312: | Emergency and Hazardous Inventory |
| SARA Section 313: | Toxic Chemicals and Release Reporting |
| STEL: | Short Term Exposure Limit |
| SVF: | Synthetic Vitreous Fiber |
| TDG: | Transportation of Dangerous Goods |
| TLV: | Threshold Limit Value (ACGIH) |
| TSCA: | Toxic Substances Control Act |
| TWA: | Time Weighted Average |
| WHMIS: | Workplace Hazardous Materials Information System (Canada) |

Revision Summary: Section 3: IARC update, Section 8: Respiratory Protection table expanded, Section 11: Minor changes, Section 16: Added PSP2002 information.

MSDS Prepared By: UNIFRAX RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Material Safety Data Sheet. Employers may use this MSDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this MSDS. Therefore, given the summary nature of this document, Unifrax Corporation does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



More **Unifrax** High Temperature Insulation Information On The Web:

| | |
|--|---|
| Official Unifrax High Temperature Insulation Website | http://www.unifrax.com |
| Unifrax High Temperature Insulation Information | http://www.high-temperature-insulation.com |
| Unifrax Refractory Ceramic Fiber Information | http://www.refractory-ceramic-fiber.com |
| Official Fiberfrax Refractory Ceramic Fiber High Temperature Insulation Information | http://www.fiberfrax.com |
| Official Foamfrax Advanced High Temperature Insulation Information | http://www.foamfrax.com |
| Official Insulfrax Soluble Fiber High Temperature Insulation Information | http://www.insulfrax.com |
| Official Isofrax Soluble Fiber High Temperature Insulation Information | http://www.isofrax.com |
| Official Fyrewrap Fire Prevention Products Information | http://www.fyrewrap.com |



MATERIAL SAFETY DATA SHEET

MSDS No: 201

Date Prepared: 10/01/1985

Current Date: 8/29/2002

Last Revised: (03/01/2002)

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Group: REFRACTORY CERAMIC FIBER PRODUCT
Chemical Name: VITREOUS ALUMINOSILICATE FIBER
Synonyms: RCF, ceramic fiber, synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF)
Trade Names: Kaowool®; Cerafiber®; Cerawool®; Cerachem®; Uni-Bloc®; Saber-Bloc®; Quad-Bloc™; Pyro-Fold®; Ultrafelt®; Pyro-Blanket®; Pyro-Log™; Cerablanket®; Z-Blok®; Pyro-Bloc® Blanket, Modules, Strips, Bulk, Packing, Insulation, Shapes, Rope, Engineered Fiber, Heat Treated Blanket (all grades)
Manufacturer/Supplier: Thermal Ceramics Inc.
P. O. Box 923; Dept. 300
Augusta, GA 30903-0923

**For Product Stewardship and Emergency Information -
Hotline: 1-800-722-5681
Fax: 706-560-4054**

For additional MSDSs and to confirm this is the most current MSDS for the product, visit our web page [www.thermalceramics.com] or call our automated FaxBack: 1-800-329-7444

2. COMPOSITION / INFORMATION ON INGREDIENTS

| <u>COMPONENTS</u> | <u>CAS NUMBER</u> | <u>% BY WEIGHT</u> |
|---------------------------------------|-------------------|--------------------|
| Refractories, Fibers, Aluminosilicate | 142844-00-6 | 100 |

(See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING!
POSSIBLE CANCER HAZARD BY INHALATION.

(See Section 11 for more information)

CHRONIC EFFECT

There has been no increased incidence of respiratory disease in studies examining occupationally exposed workers. In animal studies, long term laboratory exposure to doses hundreds of times higher than normal occupational exposures has produced fibrosis, lung cancer and mesothelioma in rats or hamsters. The fibers used in those studies were specially sized to maximize rodent respirability.

OTHER POTENTIAL EFFECTS**TARGET ORGANS:**

Respiratory Tract (nose and throat), Eyes, Skin

RESPIRATORY TRACT (nose and throat) IRRITATION:

If inhaled in sufficient quantity, may cause temporary, mild mechanical irritation to respiratory tract. Symptoms may include scratchiness of the nose or throat, cough or chest discomfort.

EYE IRRITATION:

May cause temporary, mild mechanical irritation. Fibers may be abrasive; prolonged contact may cause damage to the outer surface of the eye.

SKIN IRRITATION:

May cause temporary, mild mechanical irritation. Exposure may also result in inflammation, rash or itching.

GASTROINTESTINAL IRRITATION:

Unlikely route of exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Pre-existing medical conditions, including dermatitis, asthma or chronic lung disease may be aggravated by exposure; individuals who have a history of allergies may experience greater amounts of skin and respiratory irritation.

HAZARD CLASSIFICATION

Although studies, involving occupationally exposed workers, have not identified any increased incidence of respiratory disease, results from animal testing have been used as the basis for hazard classification. In each of the following cases, the conclusions are qualitative only and do not rest upon any quantitative analysis suggesting that the hazard actually may occur at current occupational exposure levels.

The **International Agency for Research on Cancer (IARC)** confirmed in October 2001 that Group 2B (possible human carcinogen based on sufficient evidence of carcinogenicity in animals but inadequate evidence in humans) continues to be the appropriate classification for refractory ceramic fiber.

The Seventh Annual Report on Carcinogens (1994), prepared by the **National Toxicology Program (NTP)**, classified respirable RCF and glasswool as substances reasonably anticipated to be carcinogens.

The **American Conference of Governmental Industrial Hygienists (ACGIH)** has classified RCF as "A2-Suspected Human Carcinogen."

The **Commission of The European Communities (DG XI)** has classified RCF as a substance "that should be regarded as if it is carcinogenic to man."

The **State of California**, pursuant to Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986, has listed "ceramic fibers (airborne fibers of respirable size)" as a chemical known to the State of California to cause cancer.

The **Canadian Environmental Protection Agency (CEPA)** has classified RCF as "probably carcinogenic" (Group 2).

The **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A - Materials Causing Other Toxic Effects.

The **Hazardous Materials Identification System (HMIS)** –

Health 1* Flammability 0 Reactivity 0 Personal Protection Index: X (Employer Determined)
(* denotes potential for chronic effects)

4. FIRST AID MEASURES**RESPIRATORY TRACT (nose and throat) IRRITATION:**

If respiratory tract irritation develops, move the person to a dust free location. See Section 8 for additional measures to reduce or eliminate exposure.

EYE IRRITATION:

If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes.

SKIN IRRITATION:

If skin becomes irritated, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:

If gastrointestinal tract irritation develops, move the person to a dust free environment.

- If the above symptoms persist, seek medical attention. -

NOTES TO PHYSICIANS:

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

NFPA Codes: Flammability: 0 Health: 1 Reactivity: 0 Special: 0

NFPA Unusual Hazards: None
 Flammable Properties: None
 Flash Point: None
 Hazardous Decomposition Products: None
 Unusual Fire and Explosion Hazard: None
 Extinguishing Media: Use extinguishing media suitable for type of surrounding fire

6. ACCIDENTAL RELEASE MEASURES**SPILL PROCEDURES**

Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum should be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

7. HANDLING AND STORAGE**STORAGE**

Store in original container in a dry area. Keep container closed when not in use.

HANDLING

Handle ceramic fiber carefully. Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**EXPOSURE GUIDELINES**

| <i>MAJOR COMPONENT</i> | <i>OSHA PEL</i> | <i>MANUFACTURER'S REG.</i> |
|---------------------------------------|-------------------|----------------------------|
| Refractories, Fibers, Aluminosilicate | None Established* | 0.5 f/cc, 8-hr. TWA** |

* There is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally - Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

** The Refractory Ceramic Fibers Coalition (RCFC) has sponsored comprehensive toxicology and epidemiology studies to identify potential RCF-related health effects [see Section 11 for more details], consulted experts familiar with fiber and particle science, conducted a thorough review of the RCF-related scientific literature, and further evaluated the data in a state-of-the-art quantitative risk assessment. Based on these efforts and in the absence of an OSHA PEL, RCFC has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. The manufacturers' REG is intended to promote occupational health and safety through feasible exposure controls and reductions as determined by extensive industrial hygiene monitoring efforts undertaken voluntarily and pursuant to an agreement with the U.S. Environmental Protection Agency.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: Australia – 0.5 f/cc; Austria – 0.5 f/cc; Canada – 0.5 to 1.0 f/cc; Denmark – 1.0 f/cc; France – 0.6 f/cc; Germany – 0.5 f/cc (0.25 f/cc for new installations); Netherlands – 1.0 f/cc; New Zealand – 1.0 f/cc; Norway – 2.0 f/cc; Poland – 2.0 f/cc; Sweden – 1.0 f/cc; United Kingdom – 2.0 f/cc. Non-regulatory OEL examples include: ACGIH TLV – 0.2 f/cc; RCFC REG – 0.5 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

ENGINEERING CONTROLS

Use feasible engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

PERSONAL PROTECTION EQUIPMENT

Respiratory Protection – RCF:

When engineering and/or administrative controls are insufficient to maintain workplace exposures within the 0.5 f/cc REG, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The following information is provided as an example of appropriate respiratory protection for aluminosilicate fibers. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

| MANUFACTURER'S RESPIRATORY PROTECTION RECOMMENDATIONS WHEN HANDLING RCF PRODUCTS | |
|---|--|
| <u>Respirable Airborne Fiber Concentration</u> | <u>Respirator Recommendation ¹</u> |
| Not yet determined but expected to be below 5.0 f/cc based on operation | Half-face, air-purifying respirator equipped with a NIOSH-certified P100 particulate filter cartridge. |
| "Reliably" less than 0.5 f/cc | See recommendation below for individual worker requests. |
| 0.5 f/cc – 5.0 f/cc | Half-face, air-purifying respirator equipped with a NIOSH – certified P100 particulate filter cartridge. |
| 5.0 f/cc – 25 f/cc | Full-facepiece, air-purifying respirator equipped with a NIOSH – certified P100 particulate filter cartridge or PAPR. |
| Greater than 25 f/cc | PAPR with tight-fitting full facepiece or a supplied air respirator in continuous flow mode. |
| When individual workers request respiratory protection as a matter of personal comfort or choice and exposures are "reliably" below 0.5 f/cc (8-hr., TWA) | A NIOSH-certified respirator, such as a disposable particulate respirator or respirators with filter cartridges rated N95 or better. |

¹ Note: The P100 recommendation is a conservative default choice; in some cases, solid arguments can be made that other respirator types (e.g., N95, R99, etc.) may be suitable for some tasks or work environments. The P100 recommendation is not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

Other Information:

- ◆ Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.

- ◆ The manufacturer recommends the use of a full-facepiece, air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica. If exposure levels are known, the respiratory protection chart provided above may be applied.
- ◆ Potential exposure to other airborne contaminants should be evaluated by a qualified Industrial Hygienist for the selection of appropriate respiratory protection and air monitoring.
- ◆ In the absence of other objective data or when concentrations are unknown, the manufacturer recommends the use of a half-face, air-purifying respirator equipped with a NIOSH-certified P-100 particulate filter cartridge (See above note).

Skin Protection:

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed work clothing home. If soiled work clothing must be taken home, employers should ensure employees are trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---------------------------------|-----------------------------------|
| ODOR AND APPEARANCE: | White, odorless, fibrous material |
| CHEMICAL FAMILY: | Vitreous Aluminosilicate Fibers |
| BOILING POINT: | Not Applicable |
| WATER SOLUBILITY (%): | Not Soluble in Water |
| MELTING POINT: | 1760° C (3200° F) |
| SPECIFIC GRAVITY: | 2.50 – 2.75 |
| VAPOR PRESSURE: | Not Applicable |
| pH: | Not Applicable |
| VAPOR DENSITY (Air = 1): | Not Applicable |
| % VOLATILE: | Not Applicable |
| MOLECULAR FORMULA: | Not Applicable |

10. STABILITY AND REACTIVITY

| | |
|--|---------------------------------------|
| CHEMICAL STABILITY: | Stable under conditions of normal use |
| INCOMPATIBILITY: | None |
| CONDITIONS TO AVOID: | None |
| HAZARDOUS DECOMPOSITION PRODUCTS: | None |
| HAZARDOUS POLYMERIZATION: | Not Applicable |

11. TOXICOLOGICAL INFORMATION**HEALTH DATA SUMMARY:**

Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

EPIDEMIOLOGY:

The University of Cincinnati is conducting an ongoing epidemiologic investigation. The evidence obtained from employees in U. S. RCF manufacturing facilities is as follows:

- 1) There is no evidence of any fibrotic lung disease (interstitial fibrosis) from evaluations of chest X-rays.
- 2) There is no evidence of an elevated incidence of lung disease among RCF manufacturing employees.
- 3) In early studies an apparent statistical "trend" within the exposed population was observed between RCF exposure duration and some measures of lung function. The observations were clinically insignificant. If these observations were made on an individual employee, the results would be interpreted as being within the normal (predicted) respiratory range. A more recent longitudinal study of employees with 5 or more pulmonary function tests refutes the earlier observations, finding no effect on lung function associated with RCF production experience. Initial data (circa 1987) seemed to indicate an interactive effect between smoking and RCF exposure; more recent data, however, found no interactive effect. Nevertheless, to promote good health, RCF employees are still actively encouraged not to smoke.
- 4) Pleural plaques (thickening along the chest wall) have been observed in a small number of RCF employees. Some studies appear to show a relationship between the occurrence of pleural plaques on chest radiographs and the following variables: (a) years since RCF production hire date; (b) duration of RCF production employment; and (c) cumulative RCF exposure. The best evidence to date indicates that pleural plaques are a marker of exposure only. Pleural plaques are not associated with pulmonary impairment. The pathogenesis of pleural plaques remains incompletely understood; however, the mechanism appears to be an inflammatory response caused by inhaled fibers.

TOXICOLOGY:

A number of toxicological studies designed to identify any potential health effects from RCF exposure have been completed. In one study, conducted by the Research and Consulting Company, (Geneva, Switzerland), rats and hamsters were exposed to 30 mg/m³ (about 200 fibers/cc) of specially-prepared RCF for 6 hours/day, 5 days/week, for up to 24 months. In rats, a statistically significant increase in lung tumors was observed; two mesotheliomas (cancer of the pleural lining between the chest wall and lung) were also identified. Hamsters did not develop lung tumors; however, interstitial fibrosis and mesothelioma was found. Some, in the scientific community, have concluded that the "maximum tolerated dose" was exceeded and that significant particle contamination was a confounding issue; therefore, these study findings may not represent an accurate assessment of the potential for RCF to produce adverse health effects.

In a related multi-dose study with a similar protocol, other rats were exposed to doses of 16 mg/m³, 9 mg/m³, 3 mg/m³ which corresponds to about 115, 75, and 25 fibers per cubic centimeter respectively. This study found no statistically significant increase in lung cancer. Some cases of pleural and parenchymal fibrosis were seen in the 16 mg/m³ dose group. Some cases of mild fibrosis and one mesothelioma were observed in the 9 mg/m³ group. No acute respiratory effects were seen in the rats in the 3 mg/m³ exposure group, which suggests that there may be a dose/response threshold, below which irreversible respiratory impacts do not occur.

Other toxicological studies have been conducted which utilized non-physiological exposure methods such as intrapleural, intraperitoneal and intratracheal implantation or injection. Some of these studies have found that RCF is a potential carcinogen. Some experts, however, suggest that these tests have limited relevance because they bypass many of the biological mechanisms that prevent fiber deposition or facilitate fiber clearance.

To obtain more epidemiology or toxicology information, please call the toll free telephone number for the Thermal Ceramics Product Stewardship Program found in Section 16 - Other Information.

12. ECOLOGICAL INFORMATION

No ecological concerns have been identified.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL:

RCF, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). As manufactured, RCF was tested using EPA's Toxicity Characteristic Leaching Procedure (TCLP). Results showed there were no detectable contaminants or detectable leachable contaminants that exceeded the regulatory levels. Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION**U.S. DEPARTMENT OF TRANSPORTATION (DOT)**

| | | | |
|---------------|----------------|-----------------------------|----------------|
| Hazard Class: | Not Regulated | United Nations (UN) Number: | Not Applicable |
| Labels: | Not Applicable | North America (NA) Number: | Not Applicable |
| Placards: | Not Applicable | Bill of Lading: | Product Name |

INTERNATIONAL

Canadian TDG Hazard Class & PIN: Not regulated
Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION**UNITED STATES REGULATIONS**

EPA: **Superfund Amendments and Reauthorization Act (SARA)** Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).
Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is not required to be listed on the TSCA inventory.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** - RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA: Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

California: Ceramic fibers (airborne particles of respirable size) is listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States: RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada: **Canadian Workplace Hazardous Materials Information System (WHMIS)** - RCF is classified as Class D2A - Materials Causing Other Toxic Effects
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substances List (DSL)

European Union: **European Directive 97/69/EC** classified RCF as a Category 2 carcinogen; that is it "should be regarded as if it is carcinogenic to man."

16. OTHER INFORMATION**RCF DEVITRIFICATION:**

As produced, all RCF fibers are vitreous (glassy) materials that do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline silica (cristobalite) formation may begin at temperatures of approximately 1200° C (2192° F). The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "in making the overall evaluation, the Working Group noted that carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens."

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 µg/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 µg/cm²).

RCF AFTER-SERVICE REMOVAL:

Respiratory protection should be provided in compliance with the Product Stewardship Program and OSHA standards. During removal operations, a FULL FACE RESPIRATOR is recommended to reduce inhalation exposure along with eye and respiratory tract irritation. A specific evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case-by-case basis, by a qualified industrial hygiene professional.

PRODUCT STEWARDSHIP PROGRAM:

Thermal Ceramics has established a program to provide customers with up-to-date information regarding the proper use and handling of RCF. In addition, Thermal Ceramics has established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Thermal Ceramics Product Stewardship Information Hotline at 1-800-722-5681.

DEFINITIONS:

| | |
|--|--|
| ACGIH: | American Conference of Governmental Industrial Hygienists |
| ADR: | Carriage of Dangerous Goods by Road (International Regulation) |
| CAA: | Clean Air Act |
| CAS: | Chemical Abstracts Service |
| CERCLA: | Comprehensive Environmental Response, Compensation and Liability Act |
| DSL: | Domestic Substances List |
| EPA: | Environmental Protection Agency |
| EU: | European Union |
| f/cc: | Fibers per cubic centimeter |
| HEPA: | High Efficiency Particulate Air |
| HMIS: | Hazardous Materials Identification System |
| IARC: | International Agency for Research on Cancer |
| IATA: | International Air Transport Association |
| IMDG: | International Maritime Dangerous Goods Code |
| mg/m³: | Milligrams per cubic meter of air |
| mmpcf: | Million particles per cubic meter |
| NFPA: | National Fire Protection Association |
| NIOSH: | National Institute for Occupational Safety and Health |
| OSHA: | Occupational Safety and Health Administration |
| 29 CFR 1910.134 & 1926.103: | OSHA Respiratory Protection Standards |
| 29 CFR 1910.1200 & 1926.59: | OSHA Hazard Communication Standards |
| PEL: | Permissible Exposure Limit (OSHA) |
| PIN: | Product Identification Number |
| PNOC: | Particulates Not Otherwise Classified |
| PNOR: | Particulates Not Otherwise Regulated |
| PSP: | Product Stewardship Program |
| RCFC: | Refractory Ceramic Fibers Coalition |
| RCRA: | Resource Conservation and Recovery Act |
| REG: | Recommended Exposure Guideline (RCFC) |
| REL: | Recommended Exposure Limit (NIOSH) |
| RID: | Carriage of Dangerous Goods by Rail (International Regulations) |
| SARA: | Superfund Amendments and Reauthorization Act |
| SARA Title III: | Emergency Planning and Community Right to Know Act |
| SARA Section 302: | Extremely Hazardous Substances |
| SARA Section 304: | Emergency Release |
| SARA Section 311: | MSDS/List of Chemicals and Hazardous Inventory |
| SARA Section 312: | Emergency and Hazardous Inventory |
| SARA Section 313: | Toxic Chemicals and Release Reporting |
| STEL: | Short Term Exposure Limit |
| SVF: | Synthetic Vitreous Fiber |
| TDG: | Transportation of Dangerous Goods |
| TLV: | Threshold Limit Value (ACGIH) |
| TSCA: | Toxic Substances Control Act |
| TWA: | Time Weighted Average |
| WHMIS: | Workplace Hazardous Materials Information System (Canada) |

Revision Summary:

MSDS revised in its entirety with updated information.

MSDS Prepared By:

THERMAL CERAMICS ENVIRONMENTAL, HEALTH & SAFETY DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Material Safety Data Sheet. Employers may use this MSDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this MSDS. Therefore, given the summary nature of this document, Thermal Ceramics does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



MATERIAL SAFETY DATA SHEET

| | | |
|---------------------|----------------------------------|-----------------------------------|
| MSDS No: 350 | Date Prepared: 03/24/1992 | Current Date: 8/25/2006 |
| | | Last Revised: (08/18/2006) |

1. PRODUCT AND COMPANY IDENTIFICATION

Product Group: ALKALINE EARTH SILICATE (AES) WOOL PRODUCT

Chemical Name: Calcium-Magnesium-Silicate Wool (SW 607) *or* Calcium-Magnesium-Zirconium-Silicate Wool (SW 612)

Synonyms: CMS, Synthetic Vitreous Fiber (SVF), Man-made Vitreous Fiber (MMVF), Man-made Mineral Fiber (MMMMF)

Trade Names: Superwool™ (*) Bulk, Blanket, Mat, Module, Isoblanket-E®, Engineered Fiber (ALL GRADES), Mix 436-C Component "A"; FireMaster 607 Blanket, Bulk; CALSIMAG® (Pyroscat) CSM Blanket, Bulk

Manufacturer/Supplier: Thermal Ceramics Inc.
P. O. Box 923; Dept. 300
Augusta, GA 30903-0923

**For Product Stewardship and Emergency Information -
Hotline: 1-800-722-5681
Fax: 706-560-4054**

For additional MSDSs and to confirm this is the most current MSDS for the product, visit our web page [www.thermalceramics.com].

* Superwool™ is a trademark of The Morgan Crucible Company plc

2. COMPOSITION/INFORMATION ON INGREDIENTS

| <u>INGREDIENT & CAS NUMBER</u> | <u>% BY WEIGHT</u> | <u>OSHA PEL</u> | <u>ACGIH TLV</u> |
|---|--------------------|--|--|
| Calcium-Magnesium-Silicate Mixture ⁽¹⁾ 329211-92-9 (SW 607) | 100 | 15 mg/m ³ (total dust) 5 mg/m ³ (respirable dust) | 10 mg/m ³ (inhalable dust) 3 mg/m ³ (respirable dust) |
| <i>or</i> | | | |
| Calcium-Magnesium-Zirconium-Silicate Mixture ⁽¹⁾ 308084-09-5 (SW 612) | 100 | 15 mg/m ³ (total dust) 5 mg/m ³ (respirable dust) | 10 mg/m ³ (inhalable dust) 3 mg/m ³ (respirable dust) |

⁽¹⁾ May contain alumina and titania as minor constituents

(See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.)

3. HAZARDS IDENTIFICATION

- May cause temporary, mild mechanical irritation to the eyes, skin, nose and/or throat.
- Pre-existing skin and respiratory conditions may be aggravated by exposure.

4. FIRST AID MEASURES

RESPIRATORY TRACT (nose and throat) IRRITATION

If respiratory tract irritation develops, move the person to a dust free location. See Section 8 for additional measures to reduce or eliminate exposure.

EYE IRRITATION

If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes.

SKIN IRRITATION

If skin becomes irritated, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION

If gastrointestinal tract irritation develops, move the person to a dust free environment.

- If symptoms persist, seek medical attention. -

NOTE TO PHYSICIANS

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

NFPA Codes: Flammability: 0, Health: 1, Reactivity: 0, Special: 0

| | |
|------------------------------------|--|
| NFPA Unusual Hazards: | None |
| Flammable Properties: | None |
| Flash Point: | None |
| Hazardous Decomposition Products: | None |
| Unusual Fire and Explosion Hazard: | None |
| Extinguishing Media: | Use extinguishing media suitable for type of surrounding fire. |

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES

Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum should be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

7. HANDLING AND STORAGE

STORAGE

Store in original factory container in a dry area. Keep container closed when not in use.

HANDLING

Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Do not reuse the container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

MANUFACTURER'S RECOMMENDATION

It is prudent to reduce exposure to respirable dusts to the lowest attainable level through the use of engineering controls such as ventilation and dust collection devices. Industrial hygiene standards and occupational exposure limits may vary between countries, state and local jurisdictions. Contact your employer to determine which exposure levels apply to your facility. If no regulatory dust or other standards apply, a qualified industrial hygienist can assist with a specific workplace evaluation including recommendations for respiratory protection. In the absence of such guidance, the manufacturer generally recommends the control of CMS wool exposures to 1 fiber/cc or less.

ENGINEERING CONTROLS

Use feasible engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

PERSONAL PROTECTION EQUIPMENT

Skin Protection

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed work clothing home. If soiled work clothing must be taken home, employers should ensure employees are trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

Respiratory Protection

When it is not possible or feasible to reduce respirable dust exposures through engineering controls, employees are encouraged to use good work practices together with respiratory protection. Comply with OSHA Respiratory Protection Standards, 29 CFR 1910.134 and 29 CFR 1926.103, for the particular hazard or airborne concentrations to be encountered in the work environment. For the most current information on respirator selection, contact your supplier.

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---------------------------------|---|
| ODOR AND APPEARANCE: | White odorless material with a wool type appearance |
| CHEMICAL FAMILY: | Calcium, Magnesium, Silicate Mixture |
| BOILING POINT: | Not Applicable |
| WATER SOLUBILITY (%): | Slight |
| MELTING POINT: | 1275 - 1300°C (2327 - 2372°F) |
| SPECIFIC GRAVITY RANGE: | 2.5 - 3.0 |
| VAPOR PRESSURE: | Not Applicable |
| pH: | Not Applicable |
| VAPOR DENSITY (Air = 1): | Not Applicable |
| % VOLATILE: | Not Applicable |
| MOLECULAR FORMULA: | Not Applicable |

10. STABILITY AND REACTIVITY

| | |
|--|---------------------------------------|
| CHEMICAL STABILITY: | Stable under conditions of normal use |
| CHEMICAL INCOMPATIBILITIES: | Avoid contact with strong acids. |
| CONDITIONS TO AVOID: | None |
| HAZARDOUS DECOMPOSITION PRODUCTS: | None |
| HAZARDOUS POLYMERIZATION: | Not applicable |

11. TOXICOLOGICAL INFORMATION

TOXICOLOGY

CMS wools have been tested for their biopersistence using methods devised by the European Union. The results from these studies exonerate CMS wools from carcinogen classification under the criteria listed in Nota Q of European Commission Directive 97/69/EU.

In a lifetime carcinogenicity test, rats were exposed by inhalation for two years (5 days a week; 6 hours a day) to CMS fibers at 200 WHO fibers/ml. There was neither fibrosis nor carcinogenic response; only reversible cellular changes were seen. Further, subchronic inhalation studies on rats with CMS fibers at concentrations of 150 fibers (>20 µm long) per ml for 90 days with follow up to 1 year showed neither inflammation nor cell proliferation. All parameters studied returned rapidly to baseline levels on cessation of exposure.

After-service, CMS wools may contain crystalline phases including some forms of silica. (See Section 16) However, CMS fibers heated to 1000°C for 2 weeks were not cytotoxic to macrophage-like cells at concentrations up to 320 µg/cm². In the same test, samples of pure crystalline quartz were significantly active at 20 µg/cm².

EPIDEMIOLOGY

This material has not been the subject of an epidemiology study.

NOTE

Superwool products are members of a family of materials whose properties are distinct in several ways from other man-made mineral fibers. In October 2001 IARC re-reviewed Man-Made Vitreous Fibers and "elected not to make an overall evaluation of the newly developed fibers" [such as CMS wool] but recognized that "those that have been tested appear to have low carcinogenic potential in experimental animals."

While CMS wool is an inert material that does not react with the skin, exposures may cause temporary mild mechanical irritation to the eyes, skin, nose and/or throat (for First Aid Measurers, see Section 4). Proper handling practices and the use of protective clothing (see Section 8) can minimize irritation.

12. ECOLOGICAL INFORMATION

No adverse effects of this material on the environment are anticipated.

13. DISPOSAL INFORMATION

WASTE MANAGEMENT

To prevent waste materials becoming airborne, a covered container or plastic bagging is recommended.

RCRA

CMS wool, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). As manufactured, CMS wool was tested using EPA's Toxicity Characteristics Leaching Procedure (TCLP). Results showed there were no detectable contaminants or detectable leachable contaminants that exceeded the regulatory levels. Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

Hazard Class: Not regulated
Labels: Not applicable
Placards: Not applicable
Bill of Lading: Product name

United Nations (UN) Number: Not applicable
North America (NA) Number: Not applicable

INTERNATIONAL

Not classified as dangerous goods under ADR (road), RID (train), IATA (air) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

- SARA Title III:** This product does not contain any substances reportable under Sections 302, 304, 313 (40 CFR 372). Sections 311 and 312 apply.
- OSHA:** Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103.
- TSCA:** CMS wools have been assigned two CAS numbers; however, they are not required to be listed on the TSCA inventory.
- CERCLA:** CMS wool contains fibers with an average diameter greater than one micron and thus is not considered a CERCLA hazardous substance.
- CAA:** CMS wool contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.
- States:** CMS wools are not known to be regulated by any State. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

- Canada WHMIS:** No Canadian Workplace Hazardous Materials Information System categories apply to this product.
- Canadian EPA:** All substances in this product are listed, as required, on the Domestic Substance List (DSL).
- European Union:** These products are exonerated from any carcinogenic classification in the countries of the European Union under the provisions of Nota Q of the European Commission Directive 97/69/EC.

16. OTHER INFORMATION

SUPERWOOL™ DEVITRIFICATION

As produced, Superwools™ are vitreous (glassy) AES Wools that do not contain crystalline silica. Continued exposure to elevated temperatures (>900°C) may cause these materials to form crystalline phases, including crystalline silica. The occurrence and extent of crystalline silica formation is dependent on the duration and temperature of exposure, CMS Wool chemistry and/or the presence of fluxing agents. The presence of crystalline silica can be confirmed only through laboratory analysis of the "hot face" fiber. If crystalline silica is present, follow appropriate hygiene standards and national regulations.

Devitrified, after-service Superwool™, containing crystalline silica, has shown no adverse reactions in toxicity assays (See Section 11). These findings are consistent with IARC's evaluation, which states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monograph Vol. 68, 1997).

Respirable dust from devitrified Superwool™ products can be controlled with ventilation, dust collectors or respiratory protection as detailed in Section 8 (above). Ventilation and respiratory protection should be provided in compliance with OSHA standards. The evaluation of workplace hazards and, if necessary, the identification of appropriate respiratory protection is best performed by qualified Industrial Hygienists.

For more information, call the Thermal Ceramics Product Stewardship Hotline (800-722-5681).

PRODUCT STEWARDSHIP PROGRAM

Morgan Thermal Ceramics has established a program to provide customers with up-to-date information regarding the proper use and handling of Superwool™. If you would like more information about this program, please call your local supplier or visit one of the following web sites.

Thermal Ceramics - Global
Refractory Ceramic Fibers Coalition (USA)
ECFIA (Europe)

www.thermalceramics.com
www.RCFC.net
www.ecfia.org

LABELING

As product information labels may be required on Superwool™ packages, check local destination regulations before shipping.

HMIS HAZARD RATING

HMIS Health: 1
HMIS Flammable: 0
HMIS Reactivity: 0

HMIS Personal Protective: To be determined by user

DEFINITIONS

ACGIH: American Conference of Governmental Industrial Hygienists
ADR: Carriage of Dangerous Goods by Road (International Regulation)
CAA: Clean Air Act

MSDS No: 350**Date Prepared: 03/24/1992****Current Date: 8/25/2006****Last Revised: (08/18/2006)**

CAS: Chemical Abstracts Service Registry Number
CERCLA: Comprehensive Environmental Response, Compensation and Liability Act
EPA: Environmental Protection Agency
EU: European Union
f/cc: Fibers per cubic centimeter
HEPA: High Efficiency Particulate Air
HMIS: Hazardous Materials Identification System
IARC: International Agency for Research on Cancer
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
mg/m³: Milligrams per cubic meter of air
mppcf: Million particles per cubic meter
MSHA: Mine Safety and Health Administration
NFPA: National Fire Protection Association
NIOSH: National Institute for Occupational Safety and Health
OSHA: Occupational Safety and Health Administration
PEL: Permissible Exposure Limit
PNOC: Particulates Not Otherwise Classified
PNOR: Particulates Not Otherwise Regulated
RCRA: Resource Conservation and Recovery Act
RID: Carriage of Dangerous Goods by Rail (International Regulation)
SARA: Superfund Amendments and Reauthorization Act
Title III: Emergency Planning and Community Right to Know Act
...Section 302: Extremely Hazardous Substances
...Section 304: Emergency Release
...Section 311: MSDS/List of Chemicals
...Section 312: Emergency and Hazardous Inventory
...Section 313: Toxic Chemicals Release Reporting
STEL: Short-Term Exposure Limit
TCLP: Toxicity Characteristics Leaching Procedures (EPA)
TLV: Threshold Limit Values (ACGIH)
TSCA: Toxic Substance Control Act
WHMIS: Workplace Hazardous Materials Information System (Canada)
29 CFR 1910.134 & 1926.103: OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59: OSHA Hazard Communication Standards

Revision Summary: **Section 1:** Product name added: CALSIMAG® (Pyroscat) CSM Blanket, Bulk.

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