



# INDIANA UNIVERSITY

## Laboratory Safety Guideline

### Laboratory MSDS Management, Understanding, Preparation

#### Introduction

Chemical manufacturers are required by the Occupational Health and Safety Administrations (OSHA) Hazard Communication Standard (HCS) to prepare Material Safety Data Sheets (MSDS) for their products and provide them to the people that use or may come into contact with those products. Material Safety data Sheets communicate the hazards associated with those products and important safety information to those persons.

Users of those products are required to maintain MSDS's for all chemicals (solids, liquids, and gases) and have them accessible to all employees at all times to achieve compliance with these regulations. In addition to the primary employees, this includes emergency responders, facility maintenance personnel, custodians, and others that may have to enter the workplace after normal working hours.

Synthesized chemicals or products prepared and intended for outside use (i.e. another institution, business, or product user) must comply with the MSDS requirements of the Hazard Communication Standard and prepare an MSDS for these new chemicals or products. Department of Transportation shipping requirements also apply to chemicals shipped to other locations.

#### Access to MSDS

Access to MSDS's can be provided as paper copies, electronic, or via the internet. The OSHA regulations do not require a paper copy.

[29 CFR 1910.1200(g)(8) "Electronic access, microfiche, and other alternatives to maintaining paper copies of the material safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options."]

Laboratories are strongly urged to print the MSDS sheets for their chemicals from the manufacturer that produced them and keep them in a clearly marked three ring binder in the laboratory on a bookshelf where they will be visible to all employees. Manufacturer's websites for MSDS and other chemical reference information are found in the Appendix A.

Paper copies are recommended because "employees" include maintenance and cleaning staff also and to access electronic information they must be familiar with the method of getting the MSDS on-line and have ready access to the hardware that permits that access. Additionally, provisions are needed for dealing with long-term interruptions to power, the network, or the server which would make electronic versions unavailable.

Having MSDS websites bookmarked is acceptable as long as all employees in the workplace know where to find the MSDS and are trained on the use of computers to access MSDS's. If a laboratory chooses to use electronic access, then the MSDS website link should be posted on the computer or in another conspicuous location.

Accidents involving chemicals will require an MSDS be provided to emergency response personnel and to the attending physician so proper treatment can be administered. The "rule of thumb" is that a person working in a laboratory should be able to produce an MSDS for any hazardous chemical found in the lab within five minutes.



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MSDS collections should be maintained continually. If, for example, someone reports to the emergency room with a chemical in their eyes, they need not waste time looking for the exact MSDS sheet and can take the entire binder.

MSDS's can be provided to the emergency rooms on request however this wastes precious time and is problematic. For example, if the victim only knows the trade name of the product, or the primary chemical name but not the concentration, etc., the correct MSDS may be difficult to locate.

All of this information is provided on the MSDS from the manufacturer. Therefore, it is prudent practice to maintain an MSDS for the exact chemical from the manufacturer in a binder in the laboratory.

#### Content

The HCS specifies certain information must be included on MSDSs, but does not require that any particular format be followed in presenting this information (29 CFR 1910.1200 (g)). In order to promote consistent presentation of information, OSHA recommends that MSDSs follow the 16-section format established by the American National Standards Institute (ANSI) standard for preparation of MSDSs (Z400.1). While some of this information (such as ecological information) is not required by the HCS, the 16-section MSDS is becoming the international norm. The 16 sections are:

- Identification/chemical identity
- Hazard(s) identification
- Composition/information on ingredients
- First-aid measures
- Fire-fighting measures
- Accidental release measures
- Handling and storage
- Exposure controls/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- Other information

By following this recommended format, the information of greatest concern to workers is featured at the beginning of the data sheet, including information on chemical composition and first aid measures. More technical information that addresses topics such as the physical and chemical properties of the material and toxicological data appears later in the document.

In 1985, OSHA established a voluntary format for MSDSs (OSHA Form 174) to assist those who needed guidance on preparing MSDS information. When completed correctly, an MSDS prepared using Form 174 contains all of the information required by OSHA. However, Form 174 does not use the more organized and comprehensive 16-section format.



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To prepare an MSDS, use OSHA Form 174 (attached) which is slightly modified to include Chemical Abstract Service (CAS) numbers. It must be prepared in English, but may be published in other languages in addition to English, and contains 8 sections beginning with the chemical identity as follows:

#### Chemical Identity

**The name or chemical identity on the MSDS must correspond to the name or chemical identity on the container label.** It may reflect the chemical name, manufacturer's trade name or product name.

#### Section I. Basic Product Information

1. *Manufacturers Name and Address:* This may be the chemical manufacturer, product source, or suppliers name and address.
2. *Emergency Telephone Number:* There must be 24-hour telephone access to a company representative in case of a spill, release, or personal injury. Many suppliers of hazardous materials use an emergency answering service provider such as Chemtrec under contract.
3. *Date Prepared:* Signifies the date the original MSDS information was compiled or last updated. This information should be used to verify whether a new MSDS has been updated or is a duplicate of current MSDS on file.
4. *Signature of Preparer:* Optional information, name and/or signature of the person who prepared the MSDS.

#### Section II: Hazardous Ingredients

This section lists the chemical name(s) of the hazardous components and may include the Chemical Abstract Service (CAS) number, regulatory information, and the quantity of the ingredients expressed in percent by volume or weight. A supplier may list chemical constituents as a range in percentage or as a group of hazardous constituents such a volatile organic compounds (VOC).

1. *Hazardous ingredients:* the chemical identity of the hazardous constituents including the chemical name, product name(s), synonyms, and CAS numbers as applicable.
2. *OSHA permissible exposure limit (PEL):* the legally enforceable concentration of that chemical that a worker can be exposed to without personal protection as defined by OSHA<sup>1</sup>.
3. *American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV):* chemical concentration limits recommended by ACGIH<sup>2</sup> and expressed as an 8-hour time weighted average (TWA) and 15-minute short term exposure limit (STEL).
4. *Other Limits Recommended:* any other recommended exposure limits (REL)<sup>3</sup>.
5. *Percent (%):* amount present expressed in percent by weight or volume.



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#### Section III: Physical Data

1. *Boiling Point*: The temperature in degrees F at which a liquid boils under normal atmospheric conditions.
2. *Vapor Pressure*: The pressure of saturated vapor above the liquid at 68 °F.
3. *Vapor Density*: The weight of a vapor or gas compared with an equal volume of air (=1.0) measured at 60-90 °F.
4. *Specific Gravity*: The ratio of the density of a material to the density of water (=1.0).
5. *Melting Point*: Temperature (°C or °F) at which the substance turns from a solid to a liquid phase.
6. *Evaporation Rate*: The rate the material evaporates compared to butyl acetate (=1.0).
7. *Solubility in Water*: Indicates how quickly the material combines with distilled water at 50 F. It is usually measured and expressed in the following terms:
  - Negligible: less than 0.1%
  - Slight: 0.1 to 1%
  - Moderate: 1 to 10%
  - Appreciable: more than 10%
  - Complete: in all proportions
8. *Appearance and Odor*: A brief description of the material (i.e. viscous yellow liquid with an ammonia-like odor).

#### Section IV: Fire and Explosion Data

1. *Flash Point*: The minimum temperature, in degrees Fahrenheit, at which a liquid gives off enough vapor for the material to ignite.
2. *Flammable or Explosive Limits*: The range of gas or vapor concentrations (percent by volume in air) that will burn or explode in the presence of a source of ignition expressed as the lower explosion limit (LEL) and the upper explosion limit (UEL).
3. *Extinguishing Media*: Fire fighting media suitable to extinguish the burning material. Note: Some chemicals may negatively react to water, which is the most common extinguishing media, so alternative methods, such as carbon dioxide must be identified.
4. *Special Fire Fighting Procedures*: This includes information about the toxicity of combustion products including any special personal protective equipment, etc.
5. *Unusual Fire and Explosion Hazards*: This describes any special hazards that may need attention. For example, if water is improperly applied to a flammable liquid with a flash point greater than 212 °F, a violent boiling reaction could occur.



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#### Section V. Reactivity Data

1. *Stability*: Indicates whether a chemical is stable or unstable under reasonably foreseeable conditions of storage, use, or misuse. If unstable, the potential reactions must be listed.
2. *Incompatibility*: Lists chemicals and compounds that will negatively react with the product and should not be combined or stored.
3. *Hazardous Decomposition or By-Products*: Describes the products produced as a result of heating, burning or oxidizing.
4. *Hazardous Polymerization*: Chemical reaction that releases large and potentially dangerous amount of heat. If hazardous polymerization is possible in a chemical product, the MSDS must list conditions under which it could occur.

#### Section VI. Health Hazard Data

1. *Routes of Entry*: Specifies the pathways by which the material could enter the body (i.e. skin or eye contact, oral ingestion, respiration, or injection).
2. *Health Hazards (acute and chronic)*: Specifies the effects of short-term (acute) and long-term (chronic) overexposure.
3. *Carcinogenicity*: Indicates whether or not the product is a known or suspected cause of cancer.
4. *Signs/Symptoms of Exposure*: Describes the physical effects of acute and chronic exposure.
5. *Medical Conditions Generally Aggravated by Exposure*: Lists potential medical conditions which will worsen as a result of exposure to this product.
6. *Emergency and First Aid Procedures*: Recommendations on how to treat victims of overexposure.

#### Section VII: Spill and Leak Procedures

1. *Steps to be Taken in Case Material is Released or Spilled*: Describes special precautions if the material is spilled (i.e. evacuation).
2. *Waste Disposal Method*: Dispose of all hazardous materials in accordance with Federal, state, and local regulations. Note: This area rarely describes how the product should be disposed because state and local waste disposal regulations differ.
3. *Precautions to be Taken in Handling and Storing*: Provides special instructions such as temperature control, light exposure, etc., to avoid product degradation or improper handling and storage.
4. *Other Precautions*: Any other precautionary information.



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#### Section VIII: Control Measures

1. *Respiratory Protection*: Describes respiratory protection necessary to avoid inhalation exposure.
2. *Ventilation*: Describes ventilation necessary to avoid overexposure.
3. *Protective Gloves*: Describes hand protection necessary while handling the product.
4. *Eye Protection*: Describes eye protection necessary while handling product.
5. *Other Protective Clothing or Equipment*: Describes body protection necessary while handling product plus any additional personal protective equipment.
6. *Work/Hygienic Practices*: Describes necessary personal protective procedures such as hand washing prior to consuming food or beverages, etc.

#### **References**

*Toxic and Hazardous Substances*, Title 29, Code of Federal Regulations, Part 1910, Subpart Z (29 CFR 1910, Subpart Z).

*Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, TLV's and BEI's*, NIOSH, American Conference of Governmental Industrial Hygienists (ACGIH).

*Pocket Guide to Chemical Hazards*, US Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH).

**Note:** For assistance please contact the Indiana University Office of Environmental, Health, and Safety Management, (812) 855-6311.



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#### Appendix A

#### MSDS Resources

([www.ehs.indiana.edu/lab\\_msds.html](http://www.ehs.indiana.edu/lab_msds.html))

#### Chemical Manufacturers

[3M](#)  
[Alfa Aesar](#)  
[Dow Chemical](#)  
[DuPont](#)  
[Kodak](#)  
[Fisher Scientific](#)  
[Elinn Scientific](#)  
[GFS Chemicals](#)  
[Hach](#)  
[Mallinckrodt Baker](#)  
[Sigma-Aldrich/Fluka/Supelco](#)  
[Spectrum Chemicals](#)  
[VWR Scientific Products](#)

#### Gases

[Air Gas](#)  
[Air Products](#)  
[BOC Gases](#)  
[Indiana Oxygen](#)  
[Linde Group Gases](#)  
[Matheson Tri-Gas](#)  
[Praxair](#)

#### Additional MSDS Resources

[Canadian Centre for Occupational Health and Safety \(IU subscriber\)](#)  
[MSDS Search](#)  
[CHEMINFO](#)  
[Cornell University](#)  
[MSDS Search](#)  
[Toxic Substances Control Act \(TSCA\) Chemical Substances Inventory](#)  
[Environment, Health and Safety Online \(EHSO\)](#)  
[Interactive Learning Paradigms, Inc. - MSDS Links](#)  
[Kansas State University - MSDS Links](#)  
[Laboratory Safety Institute Weblinks](#)  
[MSDS SEARCH National Repository](#)  
[Oxford University – Chemical Information and MSDS's](#)  
[Public Health Agency of Canada - Biological MSDS's](#)  
[Purdue Cataloged MSDS Sheets](#)  
[Vermont Safety Information Resources, Inc., \(SIRI\)](#)  
[SIRI MSDS Search](#)

#### Chemical Information Databases

[Cambridge Software – ChemFinder \(IU subscriber\)](#)  
[CDC Agency for Toxic Substances and Disease Registry \(ASTDR\)](#)  
[Chemical Agents](#)  
[Medical Management Guidelines](#)  
[ToxFAQs](#)  
[Department of Transportation \(DOT\) Emergency Response Handbook](#)  
[EPA Chemical Fact Sheets](#)  
[ETOXNET - Extension Toxicology Network Pesticide Information Profiles \(PIPs\)](#)  
[Howard Hughes Medical Institute - Chemical Safety Summaries \(Prudent Practices in the Laboratory\)](#)  
[International Program on Chemical Safety \(IPCS\)](#)  
[International Agency for Research on Cancer \(IARC\)](#)  
[Lab Safety Supply - EZ Facts](#)  
[Michigan State University – NFPA Chemical Ratings](#)  
[National Institute for Occupational Health \(NIOSH\)](#)  
[NIOSH Pocket Guide to Chemical Hazards](#)  
[International Safety Cards \(WHO/IPCS/ILO\)](#)  
[Immediately Dangerous to Life and Health \(IDLH\) Values](#)  
[National Institutes of Health \(NIH\) - Specialized Information Services \(SIS\)](#)  
[ChemIDplus Advanced](#)  
[TOXNET](#)  
[National Toxicology Program \(NTP\)](#)  
[National Oceanic and Atmospheric Administration - Cameo Chemical Database](#)  
[New Jersey Chemical Fact Sheets](#)  
[New Mexico State – NFPA Chemical Ratings](#)  
[New Zealand Medicines and Medical Devices Safety Authority - MEDSAFE](#)  
[Occupational Safety and Health Administration \(OSHA\)](#)  
[Oklahoma State University - NFPA Guide and Glove Permeation Tables](#)  
[University of Akron - Hazardous Chemical Database](#)



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**Appendix B**

**OSHA Form 174**

BY: CHRISTOPHER E. KOHLER, CERTIFIED CHEMICAL HYGIENE OFFICER

OFFICE OF ENVIRONMENTAL, HEALTH, AND SAFETY MANAGEMENT 1514 E. THIRD STREET BLOOMINGTON, IN 47405 (812) 855-6311  
WWW.EHS.INDIANA.EDU



SECTION V—REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE		
INCOMPATIBILITY ( <i>MATERIALS TO AVOID</i> )			
HAZARDOUS DECOMPOSITION OR BYPRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR		
SECTION VI—HEALTH HAZARD DATA			
ROUTE(S) OF ENTRY	INHALATION?	SKIN?	INGESTION?
HEALTH HAZARDS ( <i>ACUTE AND CHRONIC</i> )			
CARCINOGENICITY	NTP?	IARC MONOGRAPHS?	OSHA REGULATED?
SIGNS AND SYMPTOMS OF EXPOSURE			
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE			
EMERGENCY AND FIRST AID PROCEDURES			
SECTION VII—PRECAUTIONS FOR SAFE HANDLING AND USE			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED			
WASTE DISPOSAL METHOD			
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING			
OTHER PRECAUTIONS			
SECTION VIII—CONTROL MEASURES			
RESPIRATORY PROTECTION ( <i>SPECIFY TYPE</i> )			
VENTILATION	LOCAL EXHAUST	SPECIAL	
	MECHANICAL ( <i>GENERAL</i> )	OTHER	
PROTECTIVE GLOVES		EYE PROTECTION	
OTHER PROTECTIVE CLOTHING OR EQUIPMENT			
WORK/HYGIENIC PRACTICES			