Introduction

Chemical manufacturers are required by the Occupational Health and Safety Administration’s (OSHA) Hazard Communication Standard (HCS) to prepare chemical Safety Data Sheets (SDSs) and provide them to those that use or may come into contact with their products. Formerly known as Material Safety Data Sheets (MSDSs), the new Safety Data Sheets are prepared in a standard format in accordance with The Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Safety Data Sheets communicate the hazards and other safety information associated with those products to those that use the products.

Users of chemical products are required to maintain SDSs for all chemicals (solids, liquids, and gases) and have them accessible to all employees at all times to comply with the regulations.

Researchers preparing synthesized chemicals at Indiana University that are intended for outside use (e.g., another institution, business, or product user) must comply with the requirements of the Hazard Communication Standard and prepare an SDS for these new chemicals or products. A blank template provided by OSHA is found in Appendix B and can be used to prepare a safety data sheet for synthesized chemicals. Department of Transportation shipping requirements also apply to chemicals shipped to other locations by commercial carrier.

Access to SDS

Access to SDSs can be provided as paper copies, electronically, or via the Internet. OSHA regulations do not require a paper copy. Title 29, Code of Federal Regulations, Part 1910.1200(g)(8) states:

"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 SDSs for chemicals they use. Paper copies are recommended because electronic equipment needed to access information is dependent on uninterrupted power and network capabilities which could make electronic versions unavailable in the event of an emergency.

The SDS must come from the manufacturer that produced the chemical and correspond to the exact chemical and concentration in use or storage. The SDSs should be kept in a clearly marked three-ring binder in the laboratory on a bookshelf where they will be accessible to all employees. Manufacturers’ websites for SDSs and other chemical reference information are found in the Appendix A.

SDS services and bookmarked manufacturers’ websites are acceptable as long as all employees in the workplace are trained and know how to read and access SDSs. If a laboratory chooses to use electronic services then the SDS instructions and a link to the service should be posted on the computer and in the laboratory in a conspicuous location.

To ensure that everyone has access to SDSs, Indiana University provides on-line access to SDSs through “MSDSonline.” To access MSDS and SDS information using “MSDSonline” go to the EHS website at www.ehs.iu.edu. Click on “MSDSonline” in the right hand column then click on “MSDSonline Search” in the upper right hand tab. Type in the chemical name or CAS# and select the MSDS/SDS that corresponds to the product you use.
Accidents involving chemicals will require an SDS to be provided to emergency response personnel and to the attending physician so proper treatment can be administered. A person working in a laboratory should be able to produce an SDS for any hazardous chemical found in the lab within five minutes.

SDS 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 SDS sheet and can take the entire binder.

SDSs 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 or mixture, etc., the correct SDS may be difficult to locate.

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

Content

The HCS (29 CFR 1910.1200 (g)) specifies that certain information must be presented on SDSs using a required 16-section format in accordance with GHS and the 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 mandatory, the 16-section SDS is the international norm. The 16 sections are the following:

- Section 1, Identification/chemical identity
- Section 2, Hazard(s) identification
- Section 3, Composition/information on ingredients
- Section 4, First-aid measures
- Section 5, Fire-fighting measures
- Section 6, Accidental release measures
- Section 7, Handling and storage
- Section 8, Exposure controls/personal protection
- Section 9, Physical and chemical properties
- Section 10, Stability and reactivity
- Section 11, Toxicological information
- Section 12, Ecological information (non-mandatory)
- Section 13, Disposal considerations (non-mandatory)
- Section 14, Transport information (non-mandatory)
- Section 15, Regulatory information (non-mandatory)
- Section 16, Other information, including date of preparation or last revision.

By following this required format, the information of greatest importance to workers is featured at the beginning of the data sheet. More technical information that addresses topics such as the physical and chemical properties of the material and toxicological data appears later in the document.
Chemical Classifications

Understanding the GHS chemical classifications while reading an SDS is very important. They are different than some of the standard classifications used previously. Most SDSs present both the new classifications and previous chemical classifications.

The hazard classifications are presented in three groups: health hazards, physical hazards, and environmental hazards. Hazard categories are defined in The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) found at www.osha.gov/dsg/hazcom/ghs.html.

The following tables represent the hazard classifications, categories, and ratings for physical hazards and health hazards. The hazard categories are rated according to an alpha-numeric system under GHS beginning with a rating of 1, 1A, or A, for example, that represents the most hazardous substance in that hazard class.

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Hazard Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosives</td>
<td>Unstable</td>
</tr>
<tr>
<td>Explosives</td>
<td>Div 1.1</td>
</tr>
<tr>
<td>Flammable Gases</td>
<td>Div 1.2</td>
</tr>
<tr>
<td>Flammable Aerosols</td>
<td>Div 1.3</td>
</tr>
<tr>
<td>Oxidizing Gases</td>
<td>Div 1.4</td>
</tr>
<tr>
<td>Gases under Pressure</td>
<td>Div 1.5</td>
</tr>
<tr>
<td>Compressed gases</td>
<td>Div 1.6</td>
</tr>
<tr>
<td>Liquefied gases</td>
<td></td>
</tr>
<tr>
<td>Refrigerated liquefied gases</td>
<td></td>
</tr>
<tr>
<td>Dissolved gases</td>
<td></td>
</tr>
<tr>
<td>Flammable Liquids</td>
<td></td>
</tr>
<tr>
<td>Flammable Solids</td>
<td></td>
</tr>
<tr>
<td>Self-Reactive Chemicals</td>
<td>Type A</td>
</tr>
<tr>
<td>Pyrophoric Liquids</td>
<td>Type B</td>
</tr>
<tr>
<td>Pyrophoric Solids</td>
<td>Type C</td>
</tr>
<tr>
<td>Pyrophoric Gases</td>
<td>Type D</td>
</tr>
<tr>
<td>Pyrophoric Chemicals</td>
<td>Type E</td>
</tr>
<tr>
<td>Self-Heating Chemicals</td>
<td>Type F</td>
</tr>
<tr>
<td>Chemicals in which contact with</td>
<td>Type G</td>
</tr>
<tr>
<td>water emit flammable gases</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Liquids</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Solids</td>
<td></td>
</tr>
<tr>
<td>Organic Peroxides</td>
<td>Type A</td>
</tr>
<tr>
<td>Corrosive to Metals</td>
<td>Type B</td>
</tr>
<tr>
<td>Combustible Dust</td>
<td>Type C</td>
</tr>
<tr>
<td></td>
<td>Type D</td>
</tr>
<tr>
<td></td>
<td>Type E</td>
</tr>
<tr>
<td></td>
<td>Type F</td>
</tr>
<tr>
<td></td>
<td>Type G</td>
</tr>
<tr>
<td></td>
<td>Single Category</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
## Health Hazards

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Hazard Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity</td>
<td>1  2  3  4</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>1A 1B 1C 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>1  2A 2B</td>
</tr>
<tr>
<td>Respiratory or Skin Sensitization</td>
<td>1</td>
</tr>
<tr>
<td>Germ Cell Mutagenicinity</td>
<td>1A 1B 2</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>1A 1B 2</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>1A 1B 2</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity – Single Exposure</td>
<td>1  2  3</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity – Repeated Exposure</td>
<td>1  2</td>
</tr>
<tr>
<td>Aspiration</td>
<td>1</td>
</tr>
<tr>
<td>Simple Asphyxiants</td>
<td>Single Category</td>
</tr>
</tbody>
</table>

### References

- *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).

### Note:

For assistance please contact the Indiana University Office of Environmental, Health, and Safety Management, (812) 855-6311.
Appendix A
MSDS Resources

IU EHS SDS webpage (www.ehs.iu.edu/topics/laboratory-chemical-safety/laboratory-msds.shtml)

IU MSDS Online (https://msdsmanagement.msdsonline.com/ViewerSite/MSDSSearch.aspx)

Chemical Manufacturers

3M
Alfa Aesar
Dow Chemical
DuPont
Kodak
Fisher Scientific
Finn Scientific
GFS Chemicals
Hach
Malinckrodt 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/PCS/IL/O)
Immediately Dangerous to Life and Health (IDLH) Values
National Institutes of Health (NIH) - Specialized Information Services (SIS)
ChemDlOps 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
# Material Safety Data Sheet

**OSHA Form 174**

**U.S. Department of Labor**

**Appendix B**

MAY BE USED TO COMPLY WITH OSHA’s HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. STANDARD MUST BE CONSULTED FOR SPECIFIC REQUIREMENTS.

**IDENTITY (AS USED ON LABEL AND LIST)**

NOTE: BLANK SPACES ARE NOT PERMITTED. IF ANY ITEM IS NOT APPLICABLE OR NO INFORMATION IS AVAILABLE, THE SPACE MUST BE MARKED TO INDICATE THAT.

## Section I

**Manufacturer’s Name**

**Emergency Telephone Number**

**Address (Number, Street, City, State and ZIP Code)**

**Telephone Number for Information**

**Date Prepared**

**Signature of Preparer (optional)**

## Section II—Hazardous Ingredients/Identity Information

**Hazardous Components (Specific Chemical Identity, Common Name(s), CAS Numbers)**

<table>
<thead>
<tr>
<th>OSHA PEL</th>
<th>ACGIH TLV</th>
<th>Other Limits Recommended</th>
<th>% (Optional)</th>
</tr>
</thead>
</table>

## Section III—Physical/Chemical Characteristics

**Boiling Point**

**Specific Gravity (H2O = 1)**

**Vapor Pressure (MM HG)**

**Melting Point**

**Vapor Density (Air = 1)**

**Evaporation Rate (Butyl Acetate = 1)**

**Solubility in Water**

**Appearance and Odor**

## Section IV—Fire and Explosion Hazard Data

**Flash Point (Method Used)**

**Flammable Limits**

**LEL**

**UEL**

**Extinguishing Media**

**Special Fire Fighting Procedures**

**Unusual Fire and Explosion Hazards**

(REPRODUCE LOCALLY)

OSHA 174 Sept. 1985
### Appendix B
**OSHA FORM 174**

#### SECTION V—Reactivity Data

<table>
<thead>
<tr>
<th>Stability</th>
<th>Unstable</th>
<th>Conditions to Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stable</td>
</tr>
</tbody>
</table>

**Incompatibility (Materials to Avoid)**

<table>
<thead>
<tr>
<th>Hazardous Decomposition or Byproducts</th>
<th>May Occur</th>
<th>Conditions to Avoid</th>
<th>Will Not Occur</th>
</tr>
</thead>
</table>

#### SECTION VI—Health Hazard Data

<table>
<thead>
<tr>
<th>Route(s) of Entry</th>
<th>Inhalation?</th>
<th>Skin?</th>
<th>Ingestion?</th>
</tr>
</thead>
</table>

**Health Hazards (Acute and Chronic)**

<table>
<thead>
<tr>
<th>Carcinogenicity</th>
<th>NTP?</th>
<th>IARC Monographs?</th>
<th>OSHA Regulated?</th>
</tr>
</thead>
</table>

**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 (Specify Type)**

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>Local Exhaust</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical (General)</th>
<th>Other</th>
</tr>
</thead>
</table>

**Protective Gloves**

<table>
<thead>
<tr>
<th>Eye Protection</th>
</tr>
</thead>
</table>

**Other Protective Clothing or Equipment**

**Work/Hygienic Practices**