HAZARD COMMUNICATION

PROFESSIONAL DEVELOPMENT HOUR CONTINUING EDUCATION COURSE

1.0 CEUs, 10 PDHs, 10 T.C.s

Technical Learning College

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Professional Engineers; Most states will accept our courses for credit but we do not officially list the States or Agencies acceptance or approvals.

State Approval Listing URL…
http://www.tlch2o.com/PDF/CEU%20State%20Approvals.pdf

You can obtain a printed version from TLC for an additional $49.95 plus shipping charges.

Every product or chemical that you use at your work needs a readily available SDS. Inadequate employee training and lack of a written program are the most common OSHA violations.

Technical Learning College's Scope and Function

Technical Learning College (TLC) offers affordable continuing education for today's working professionals who need to maintain licenses or certifications. TLC holds approximately eighty different governmental approvals for granting of continuing education credit.

TLC's delivery method of continuing education can include traditional types of classroom lectures and distance-based courses or independent study. Most of TLC's distance based or independent study courses are offered in a print based format and you are welcome to examine this material on your computer with no obligation. Our courses are designed to be flexible and for you to finish the material at your leisure. Students can also receive course materials through the mail. The CEU course or e-manual will contain all your lessons, activities and assignments. Most CEU courses allow students to submit lessons using e-mail or fax, however some courses require students to submit lessons by postal mail. (See the course description for more information.) Students have direct contact with their instructor—primarily by e-mail. TLC's CEU courses may use such technologies as the World Wide Web, e-mail, CD-ROMs, videotapes and hard copies. (See the course description.) Make sure you have access to the necessary equipment before enrolling, i.e., printer, Microsoft Word and/or Adobe Acrobat Reader. Some courses may require proctored exams depending upon your state requirements.

Flexible Learning
At TLC, there are no scheduled online sessions you need contend with, nor are you required to participate in learning teams or groups designed for the "typical" younger campus based student. You work at your own pace, completing assignments in the time frame that works best for you. TLC's method of flexible individualized instruction is designed to provide each student the guidance and support needed for successful course completion.

We will beat any other training competitor's price for the same CEU material or classroom training. Student satisfaction is guaranteed.

Course Structure
TLC's online courses combine the best of online delivery and traditional university textbooks. Online you will find the course syllabus, course content, assignments, and online open book exams. This student-friendly course design allows you the most flexibility in choosing when and where you will study.

Classroom of One
TLC Online offers you the best of both worlds--you learn on your own terms, on your own time, but you are never on your own. Once enrolled, you will be assigned a personal Student Service Representative who works with you on an individualized basis throughout your program of study. Course specific faculty members are assigned at the beginning of each course, providing the academic support you need to successfully complete each course.

Satisfaction Guaranteed
Our Iron-Clad, Risk-Free Guarantee ensures you will be another satisfied TLC student.

We have many years of experience, dealing with thousands of students. We assure you, our customer satisfaction is second to none. This is one reason we have taught more than 10,000 students.

Our administrative staff is trained to provide outstanding customer service. Part of that training is knowing how to solve most problems on the spot.

TLC Continuing Education Course Material Development
Technical Learning College's (TLC's) continuing education course material development was based upon several factors; extensive academic research, advice from subject matter experts, data analysis, task analysis and training needs assessment process information gathered from other states.

We welcome you to download the assignment off our website and complete the assignment in Word. Simply e-mail or fax the assignment along with the registration page back to us. If you need your certificate within 48 hours, request a rush fee of $50.00 to expedite your order.

Course Description

Hazard Communication CEU Training Course

The basic goal of a Hazard Communication Program is to make sure employers and employees know about potential work hazards, how to recognize them and, most importantly, how to protect themselves. This seminar is designed to help reduce the possible incidence of chemical source illness and injuries.

New 2012 changes to OSHA's Hazard Communication Standard (29 CFR 1910.1200) are bringing the U.S. into alignment with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), improving safety and health protections for America's workers. These new revisions to OSHA's current Hazard Communication Standard, the GHS is expected to prevent injuries and illnesses, save lives and improve trade conditions for chemical manufacturers. The Hazard Communication Standard in 1983 gave the workers the 'right to know,' but the new Globally Harmonized System gives workers the 'right to understand.'

The new Hazard Communication Standard still requires chemical manufacturers and importers to evaluate the chemicals they produce or import and provide hazard information to employers and workers by putting labels on containers and preparing safety data sheets. However, the old standard allowed chemical manufacturers and importers to convey hazard information on labels and material safety data sheets in whatever format they chose. The modified standard provides a single set of harmonized criteria for classifying chemicals according to their health and physical hazards and specifies hazard communication elements for labeling and safety data sheets.

The Safety Data Sheet (SDS), also known as the Material Safety Data Sheet (MSDS), is at the heart of federal OSHA's hazard communication standard (HazCom). The SDS/MSDS is a detailed, written description of a hazardous chemical that must be kept in the workplace where such chemicals are used.

Significant new requirements were added to OSHA's HazCom rule that will require employers to train their employees how to read and interpret the new SDS.

Audenice - First Responders, HAZWOPER Refreshers

Water Distribution, Well Drillers, Pump Installers, Water Treatment Operators, Wastewater Operators--the target audience for this course is the person interested in working in a water treatment/wastewater treatment or distribution facility, wishing to maintain CEUs for a certification license, wanting to learn how to do the job safely and effectively, and/or to meet education needs for promotion.

Course Procedures for Registration and Support

All of Technical Learning College's distance courses have complete registration and support services offered. Delivery of services include, e-mail, web site, telephone, fax and mail support. TLC will attempt immediate and prompt service.

When a student registers for a distance or correspondence course, he/she is assigned a start date and an end date. It is the student's responsibility to note dates for assignments and keep up with the course work.

If a student falls behind, he/she must contact TLC and request an end date extension in order to complete the course. It is the prerogative of TLC to decide whether to grant the request. You may be required to pay $50.00. All students will be tracked by their social security number or a unique number will be assigned to the student.

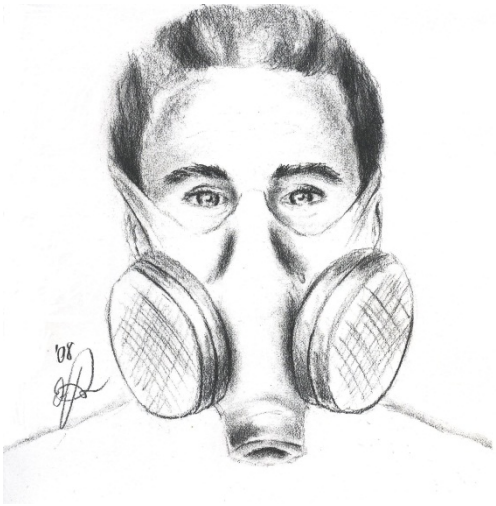
Instructions for Written Assignments
The Hazard Communication CEU Training course will be a multiple choice and final essay type of an exam. You can find this document in the assignment.

Feedback Mechanism (examination procedures)
Each student will receive a feedback form as part of their study packet. You will find this form in the rear of the course or lesson.

Security and Integrity
All students are required to do their own work. All lesson sheets and final exams are not returned to the student to discourage sharing of answers. Any fraud or deceit and the student will forfeit all fees and the appropriate agency will be notified.

Grading Criteria
In order to successfully pass this course, you will need to have 70% or better on the final exam.

Required Texts
The Hazard Communication CEU Training course does not require any course materials. The course is complete.



Recordkeeping and Reporting Practices
TLC will keep all student records for a minimum of five years. It is the student's responsibility to give the completion certificate to the appropriate agencies. We will send the required information to Texas, Indiana and Pennsylvania for your certificate renewals.

ADA Compliance
TLC will make reasonable accommodations for persons with documented disabilities. Students should notify TLC and their instructors of any special needs. Course content may vary from this outline to meet the needs of this particular group.

Educational Mission

The educational mission of TLC is:
To provide TLC students with comprehensive and ongoing training in the theory and skills needed for the environmental education field,

To provide TLC students with opportunities to apply and understand the theory and skills needed for a successful career,

To provide opportunities for TLC students to learn and practice environmental educational skills with members of the community for the purpose of sharing diverse perspectives and experience,

To provide a forum in which students can exchange experiences and ideas related to environmental education,

To provide a forum for the collection and dissemination of current information related to environmental education, and to maintain an environment that nurtures academic and personal growth.

Proper disposal is essential to a successful HAZCOM Program

Copyright Notice

COMBUSTIBLE LIQUID:
Under the Canadian Controlled Products Regulations, a combustible liquid has a flash point from 37.8 to 93.3°C (100 to 200°F) using a closed cup test. The US OSHA HazCom Standard uses a similar definition.

This range of flash points is well above normal room temperature. Combustible liquids are, therefore, less of a fire hazard than flammable liquids. If there is a possibility that a combustible liquid will be heated to a temperature near its flash point, appropriate precautions must be taken to prevent a fire or explosion.

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Acronyms/Abbreviations

The following list presents some acronyms and abbreviations used in this document. The **Glossary** contains a more complete list.

ANSI: American National Standards Institute
APEC: Asia-Pacific Economic Cooperation
ASTM: American Society of Testing and Materials
CA: Competent Authority
CAS: Chemical Abstract Service
CBI: Confidential Business Information
CFR: Code of Federal Regulations
CG/HCCS: Coordinating Group for the Harmonization of Chemical Classification Systems
CPSC: Consumer Product Safety Commission
DOT: Department of Transportation
EINECS: European Inventory of Existing Commercial Chemical Substances
EPA: Environmental Protection Agency
EU: European Union
FIFRA: Federal Insecticide, Fungicide and Rodenticide Act
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
HCS: Hazard Communication Standard
IARC: International Agency for the Research on Cancer
IFCS: International Forum on Chemical Safety
ILO: International Labor Organization
IOMC: Inter-organization Program on the Sound Management of Chemicals
ISO: International Standards Organization
IUPAC: International Union of Pure and Applied Chemistry
LD_{50} : Lethal dose 50mg/kg: Milligram per kilogram
MSDS: Material Safety Data Sheet
NAFTA: North American Free Trade Agreement
OSHA: Occupational Safety and Health Administration
OECD: The Organization for Economic Cooperation and Development
QSARs: Quantitative Structure-Activity Relationships
SDS: Safety Data Sheet
SME: Small and medium sized enterprises
TFHCL: Task Force on the Harmonization of Classification and Labeling
TSCA: Toxic Substances Control Act
UN: United Nations
UNCED: United Nations Conference on Environment and Development
UNCETDG: United Nations Committee of Experts on the Transport of Dangerous Goods
UNCETDG/GHS: United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labeling of Chemicals
UNITAR: United Nations Institute for Training and Research
WG: work group
WHMIS: Workplace Hazardous Materials Information System
WSSD: World Summit on Sustainable Development

Hazard Communication Introduction

Revised Hazard Communication Program

New 2012 changes to OSHA's Hazard Communication Standard (29 CFR 1910.1200) are bringing the U.S. into alignment with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), improving safety and health protections for America's workers. These new revisions to OSHA's current Hazard Communication Standard, the GHS is expected to prevent injuries and illnesses, save lives and improve trade conditions for chemical manufacturers. The Hazard Communication Standard in 1983 gave the workers the 'right to know,' but the new Globally Harmonized System gives workers the 'right to understand.'

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The Safety Data Sheet (SDS), also known as the Material Safety Data Sheet (MSDS), is at the heart of federal OSHA’s hazard communication standard (HazCom). The SDS/MSDS is a detailed, written description of a hazardous chemical that must be kept in the workplace where such chemicals are used.

Significant new requirements were added to OSHA’s HazCom rule that will require employers to train their employees how to read and interpret the new SDS.

By December 1, 2013, employers must train their employees how to read and interpret the new SDS. Many employers will go through a phase-in period where both MSDSs and SDSs will be present in the workplace. During the phase-in period, employers may train their employees how to read and interpret SDSs, or MSDSs, or both at the same time. By June 1, 2015, all MSDSs must be replaced with SDSs.

As the global market has expanded to include many countries and languages so has the labeling of hazards of chemical products. Several years ago the United Nations recognized this as a problem and began a push for countries to adopt a standardized system of classification and labeling. As a result, in the very near future, OSHA plans to implement the new Globally Harmonized System of Classification and Labeling of Chemicals or better known as GHS. The goal is that the same set of rules for classifying hazards, and the same format and content for labels and Material Safety Data Sheets (now to be called Safety Data Sheets or SDS) will be adopted worldwide.

The new system, as is often the case with governmental programs, is running behind schedule. At this point OSHA expected to be well into GHS, but right now it appears it will go into effect in the Spring of 2012. Once implemented it should provide consistent hazard information, greater awareness of hazards, and safer use of chemicals. For employers the expectation is that it will reduce costs and ease compliance.

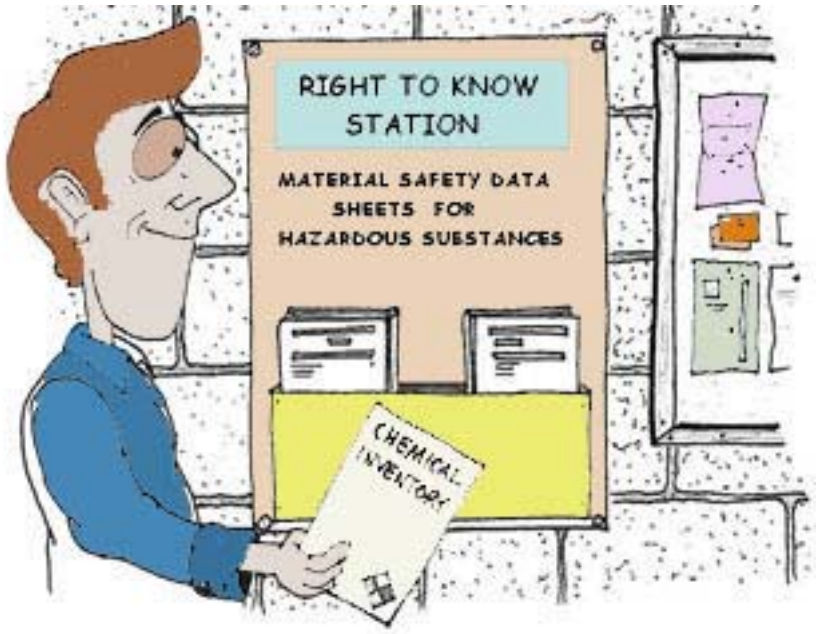
The big question for many employers is obviously…"How will GHS affect my company?" Depending on the type of operations you conduct in your company, the answers will vary. OSHA has developed some websites to help with the transitioning process.

GHS Concept	How it affects the employer	The challenge
Material Safety Data Sheets	MSDSs will become Safety Data Sheets (SDS). The new SDS will be in a standardized format and provide additional information including ecological information, disposal considerations, transport information and regulatory information. The consistent format will help employees in quickly finding information on the SDS.	Ensuring that all MSDSs are updated to the new SDS format and making sure this information is distributed accurately to employees will be difficult. One of the key challenges will be working with your chemical product vendors to produce the SDSs in a timely manner.
Container Labeling	The GHS standard will become a requirement and replace HMIS, NFPA or any other labeling system you are currently using. The new format includes pictograms, signal words and physical, health and environmental hazard statements. The labels must also have precautionary measures, pictograms and first aid statements along with complete chemical identification and manufacturer contact information.	Properly labeling all secondary and tertiary containers is a significant task. The employer must ensure all containers are labeled properly. This includes original containers received from vendors. Unfortunately, you cannot assume that your vendors will be able to provide the labeling information in a timely fashion. Additionally, it is unlikely OSHA will require chemical manufacturers to produce SDSs for discontinued products so employers will be stuck determining GHS labels for older products.
Training	Employees will need educated on the label and MSDS changes due to the updated product classifications, pictograms, signal words and precautionary statements. Written programs will need updated to include changes to labeling, MSDS communication and employee training.	OSHA has stated that employers will be required to train employees within 2 years of the publication of the final rule. Training employees and updating the written program will require significant resources and should occur as soon as your organization begins its GHS transition.

More on the Revised Hazard Communication Standard

"Exposure to hazardous chemicals is one of the most serious threats facing American workers today," said U.S. Secretary of Labor Hilda Solis. "Revising OSHA's Hazard Communication standard will improve the quality and consistency of hazard information, making it safer for workers to do their jobs and easier for employers to stay competitive." The Hazard Communication Standard (HCS) is now aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) .

This update to the Hazard Communication Standard (HCS) will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and safety data sheets. Once implemented, the revised standard will improve the quality and consistency of hazard information in the workplace, making it safer for workers by providing easily understandable information on appropriate handling and safe use of hazardous chemicals. This update will also help reduce trade barriers and result in productivity improvements for American businesses that regularly handle, store, and use hazardous chemicals while providing cost savings for American businesses that periodically update safety data sheets and labels for chemicals covered under the hazard communication standard.



Rationale
In order to ensure chemical safety in the workplace, information about the identities and hazards of the chemicals must be available and understandable to workers. OSHA's Hazard Communication Standard (HCS) requires the development and dissemination of such information:

- Chemical manufacturers and importers are required to evaluate the hazards of the chemicals they produce or import, and prepare labels and safety data sheets to convey the hazard information to their downstream customers;

- All employers with hazardous chemicals in their workplaces must have labels and safety data sheets for their exposed workers, and train them to handle the chemicals appropriately.

-

Major changes to the Hazard Communication Standard

- **Hazard classification**: Provides specific criteria for classification of health and physical hazards, as well as classification of mixtures.
- **Labels**: Chemical manufacturers and importers will be required to provide a label that includes a harmonized signal word, pictogram, and hazard statement for each hazard class and category. Precautionary statements must also be provided.
- **Safety Data Sheets:** Will now have a specified 16-section format.
- **Information and training:** Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding.

Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

What is the Globally Harmonized System?

The Globally Harmonized System (GHS) is an international approach to hazard communication, providing agreed criteria for classification of chemical hazards, and a standardized approach to label elements and safety data sheets. The GHS was negotiated in a multi-year process by hazard communication experts from many different countries, international organizations, and stakeholder groups. It is based on major existing systems around the world, including OSHA's Hazard Communication Standard and the chemical classification and labeling systems of other US agencies.

The result of this negotiation process is the United Nations' document entitled "Globally Harmonized System of Classification and Labeling of Chemicals," commonly referred to as The Purple Book. This document provides harmonized classification criteria for health, physical, and environmental hazards of chemicals. It also includes standardized label elements that are assigned to these hazard classes and categories, and provide the appropriate signal words, pictograms, and hazard and precautionary statements to convey the hazards to users. A standardized order of information for safety data sheets is also provided. These recommendations can be used by regulatory authorities such as OSHA to establish mandatory requirements for hazard communication, but do not constitute a model regulation.

Why did OSHA decide to modify the Hazard Communication Standard to adopt the GHS?

OSHA has modified the Hazard Communication Standard (HCS) to adopt the GHS to improve safety and health of workers through more effective communications on chemical hazards. Since it was first promulgated in 1983, the HCS has provided employers and employees extensive information about the chemicals in their workplaces. The original standard is performance-oriented, allowing chemical manufacturers and importers to convey information on labels and material safety data sheets in whatever format they choose. While the available information has been helpful in improving employee safety and health, a more standardized approach to classifying the hazards and conveying the information will be more effective, and provide further improvements in American workplaces. The GHS provides such a standardized approach, including detailed criteria for determining what hazardous effects a chemical poses, as well as standardized label elements assigned by hazard class and category.

This will enhance both employer and worker comprehension of the hazards, which will help to ensure appropriate handling and safe use of workplace chemicals. In addition, the safety data sheet requirements establish an order of information that is standardized. The harmonized format of the safety data sheets will enable employers, workers, health professionals, and emergency responders to access the information more efficiently and effectively, thus increasing their utility.

Adoption of the GHS in the US and around the world will also help to improve information received from other countries—since the US is both a major importer and exporter of chemicals, American workers often see labels and safety data sheets from other countries. The diverse and sometimes conflicting national and international requirements can create confusion among those who seek to use hazard information effectively.

For example, labels and safety data sheets may include symbols and hazard statements that are unfamiliar to readers or not well understood. Containers may be labeled with such a large volume of information that important statements are not easily recognized. Given the differences in hazard classification criteria, labels may also be incorrect when used in other countries. If countries around the world adopt the GHS, these problems will be minimized, and chemicals crossing borders will have consistent information, thus improving communication globally.

Exposure or exposed means that an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (e.g. accidental or possible) exposure. "Subjected" in terms of health hazards includes any route of entry (e.g. inhalation, ingestion, skin contact or absorption.)

What is the phase-in period in the revised Hazard Communication Standard?
The table below summarizes the phase-in dates required under the revised Hazard Communication Standard (HCS):

Effective Completion Date	Requirement(s)	Who
December 1, 2013	Train employees on the new label elements and safety data sheet (SDS) format.	Employers
June 1, 2015* December 1, 2015	Compliance with all modified provisions of this final rule, except: The Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it is a GHS label	Chemical manufacturers, importers, distributors and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary, and provide additional employee training for newly identified physical or health hazards.	Employers
Transition Period to the effective completion dates noted above	May comply with either 29 CFR 1910.1200 (the final standard), or the current standard, or both	Chemical manufacturers, importers, distributors, and employers

*This date coincides with the EU implementation date for classification of mixtures.
During the phase-in period, employers would be required to be in compliance with either the existing HCS or the revised HCS, or both. OSHA recognizes that hazard communication programs will go through a period of time where labels and SDSs under both standards will be present in the workplace. This will be considered acceptable, and employers are not required to maintain two sets of labels and SDSs for compliance purposes.

Why must training be conducted prior to the compliance effective date?
OSHA is requiring that employees are trained on the new label elements (e.g., pictograms and signal words) and SDS format by December 2013, while full compliance with the final rule will begin in 2015. While many countries are in various stages of implementing the GHS, OSHA believes that it is possible that American workplaces may begin to receive labels and SDSs that are consistent with the GHS shortly after publication. Thus, making it important to ensure that when employees begin to see the new labels and SDSs in their workplaces, they will be familiar with them, understand how to use them, and access the information effectively.

What are the major changes to the Hazard Communication Standard?
The three major areas of change are in hazard classification, labels, and safety data sheets.

- **Hazard classification:** The definitions of hazard have been changed to provide specific criteria for classification of health and physical hazards, as well as classification of mixtures. These specific criteria will help to ensure that evaluations

of hazardous effects are consistent across manufacturers, and that labels and safety data sheets are more accurate as a result.

- **Labels:** Chemical manufacturers and importers will be required to provide a label that includes a harmonized signal word, pictogram, and hazard statement for each hazard class and category. Precautionary statements must also be provided.

- **Safety Data Sheets:** Will now have a specified 16-section format.

The GHS does not include harmonized training provisions, but recognizes that training is essential to an effective hazard communication approach. The revised Hazard Communication Standard (HCS) requires that workers be re- trained within two years of the publication of the final rule to facilitate recognition and understanding of the new labels and safety data sheets.

For a side-by-side comparison of the current HCS and the final revised HCS please see OSHA's hazard communication safety and health topics webpage at:
http://www.osha.gov/dsg/hazcom/index.html

What Hazard Communication Standard provisions are unchanged in the revised HCS?

The revised Hazard Communication Standard (HCS) is a modification to the existing standard. The parts of the standard that did not relate to the GHS (such as the basic framework, scope, and exemptions) remained largely unchanged. There have been some modifications to terminology in order to align the revised HCS with language used in the GHS. For example, the term "hazard determination" has been changed to "hazard classification" and "material safety data sheet" was changed to "safety data sheet." OSHA stakeholders commented on this approach and found it to be appropriate.

How will chemical hazard evaluation change under the revised Hazard Communication Standard?

Under both the current Hazard Communication Standard (HCS) and the revised HCS, an evaluation of chemical hazards must be performed considering the available scientific evidence concerning such hazards. Under the current HCS, the hazard determination provisions have definitions of hazard and the evaluator determines whether or not the data on a chemical meet those definitions. It is a performance-oriented approach that provides parameters for the evaluation, but not specific, detailed criteria.

The hazard classification approach in the revised HCS is quite different. The revised HCS has specific criteria for each health and physical hazard, along with detailed instructions for hazard evaluation and determinations as to whether mixtures or substances are covered. It also establishes both hazard classes and hazard categories—for most of the effects; the classes are divided into categories that reflect the relative severity of the effect. The current HCS does not include categories for most of the health hazards covered, so this new approach provides additional information that can be related to the appropriate response to address the hazard. OSHA has included the general provisions for hazard classification in paragraph (d) of the revised rule, and added extensive appendixes (Appendixes A and B) that address the criteria for each health or physical effect.

United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

1.0 Background

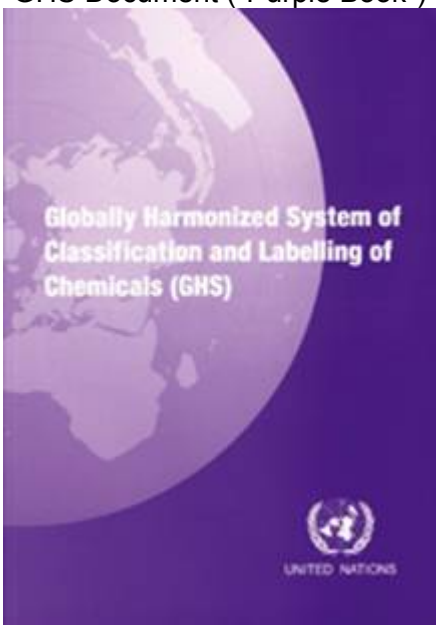
The purpose of this document is to describe the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS), why it was developed, and how it relates to the sound management of chemicals.

1.1 What is the GHS?

The GHS is an acronym for *The Globally Harmonized System of Classification and Labeling of Chemicals*. The GHS is a system for standardizing and harmonizing the classification and labeling of chemicals. It is a logical and comprehensive approach to:

- Defining health, physical and environmental hazards of chemicals;
- Creating classification processes that use available data on chemicals for comparison with the defined hazard criteria; and
- Communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

Figure 1.1
GHS Document ("Purple Book")



Many countries already have regulatory systems in place for these types of requirements. These systems may be similar in content and approach, but their differences are significant enough to require multiple classifications, labels and safety data sheets for the same product when marketed in different countries or even in the same country when parts of the life cycle are covered by different regulatory authorities. This leads to inconsistent protection for those potentially exposed to the chemicals, as well as creating extensive regulatory burdens on companies producing chemicals.

For example, in the United States (U.S.) there are requirements for classification and labeling of chemicals for the Consumer Product Safety Commission, the Department of Transportation, the Environmental Protection Agency, and the Occupational Safety and Health Administration.

The GHS itself is not a regulation or a standard. The GHS Document (referred to as "The Purple Book", shown in Figure 1.1) establishes agreed hazard classification and communication provisions with explanatory information on how to apply the system. The elements in the GHS supply a mechanism to meet the basic requirement of any hazard communication system, which is to decide if the chemical product produced and/or supplied is hazardous and to prepare a label and/or Safety Data Sheet as appropriate. Regulatory authorities in countries adopting the GHS will thus take the agreed criteria and provisions, and implement them through their own regulatory process and procedures rather than simply incorporating the text of the GHS into their national requirements. The GHS Document thus provides countries with the regulatory building blocks to develop or modify existing national programs that address classification of hazards and transmittal of information about those hazards and associated protective measures. This helps to ensure the safe use of chemicals as they move through the product life cycle from "cradle to grave."

1.2 Why was the GHS developed?

The production and use of chemicals is fundamental to all economies. The global chemical business is more than a $1.7 trillion per year enterprise. In the U.S., chemicals are more than a $450 billion business and exports are greater than $80 billion per year.

Chemicals directly or indirectly affect our lives and are essential to our food, our health, and our lifestyle. The widespread use of chemicals has resulted in the development of sector-specific regulations (transport, production, workplace, agriculture, trade, and consumer products). Having readily available information on the hazardous properties of chemicals, and recommended control measures, allows the production, transport, use and disposal of chemicals to be managed safely. Thus, human health and the environment are protected.

The sound management of chemicals should include systems through which chemical hazards are identified and communicated to all who are potentially exposed. These groups include workers, consumers, emergency responders and the public. It is important to know what chemicals are present and/or used, their hazards to human health and the environment, and the means to control them. A number of classification and labeling systems, each addressing specific use patterns and groups of chemicals, exist at the national, regional and international levels. The existing hazard classification and labeling systems address potential exposure to chemicals in all the types of use settings listed above.

While the existing laws and regulations are similar, they are different enough to require multiple labels for the same product both within the U.S. and in international trade and to require multiple safety data sheets for the same product in international trade. Several U.S. regulatory agencies and various countries have different requirements for hazard definitions as well as for information to be included on labels or material safety data sheets.

Acute oral toxicity LD_{50} (mg/kg)										
Organization/Country/ Regulation or Standard	**High**		**Hazard**						**Low**	
	0		< 50			< 500			< 5000	
ANSI/US/A 129.1	< 50 Highly Toxic		> 50 < 500 Toxic			> 500 < 2000 Harmful				
OSHA/US/HCS	< 50 Highly Toxic		> 50 < 500 Toxic							
EPA/US/FIFRA	0 ≤ 50 Toxicity Category I		> 50 ≤ 500 Toxicity Category II			> 500 < 5000 Toxic Category III			> 5000 Toxicity Category IV	
CPSC/US/FHSA	< 50 Highly Toxic		> 50 ≤ 500 Toxic							
GHS	**≤ 5**	**> 5 ≤ 50**	**> 50 ≤ 300**			**> 300 ≤ 2000**		**> 2000 ≤ 5000**		
DOT/US	< 5 Picking Group 1	> 5 < 50 Picking Group II	> 50 < 200 (solid) > 50 > 500 (liquid) Picking Group III							
NFPA/US	≤ 5 Hazard Category 4	> 5 ≤ 50 Hazard Category 3	> 50 ≤ 500 Hazard Category 2			> 500 ≤ 2000 Hazard Category 1		> 2000 Hazard Category 0		
NPCA/US/HMIS	≤ 1 Toxicity Rating 4	> 1 ≤ 50 Toxicity Rating 3	> 50 ≤ 500 Toxicity Rating 2			> 500 ≤ 5000 Toxicity Rating 1			> 5000 Toxicity Rating 0	
EU	< 25 Very Toxic	> 25 > 200 Toxic		> 200 < 2000 Harmful						
WHMIS/Canada	≤ 50 Very Toxic WHMIS Class D, Division 1, Subdivision A		> 50 ≤ 500 Toxic WHMIS Class D, Division 1, Subdivision B							
Australia/NOHSC	< 25 Very Toxic	> 25 < 200 Toxic		> 200 < 2000 Harmful						
Mexico	<1 Extremely Toxic	>20 < 50 Highly Toxic	> 50 < 500 Moderately Toxic			> 500 < 5000 Mildly Toxic				
Malaysia	< 25 Very Toxic		200 to 500 Harmful							
Japan	< 30 Poisonous					300 to 3000 Powerful				
Korea	< 25 Very Toxic	> 50 < 200 Toxic		> 200 < 2000 Harmful						

Figure 1.2

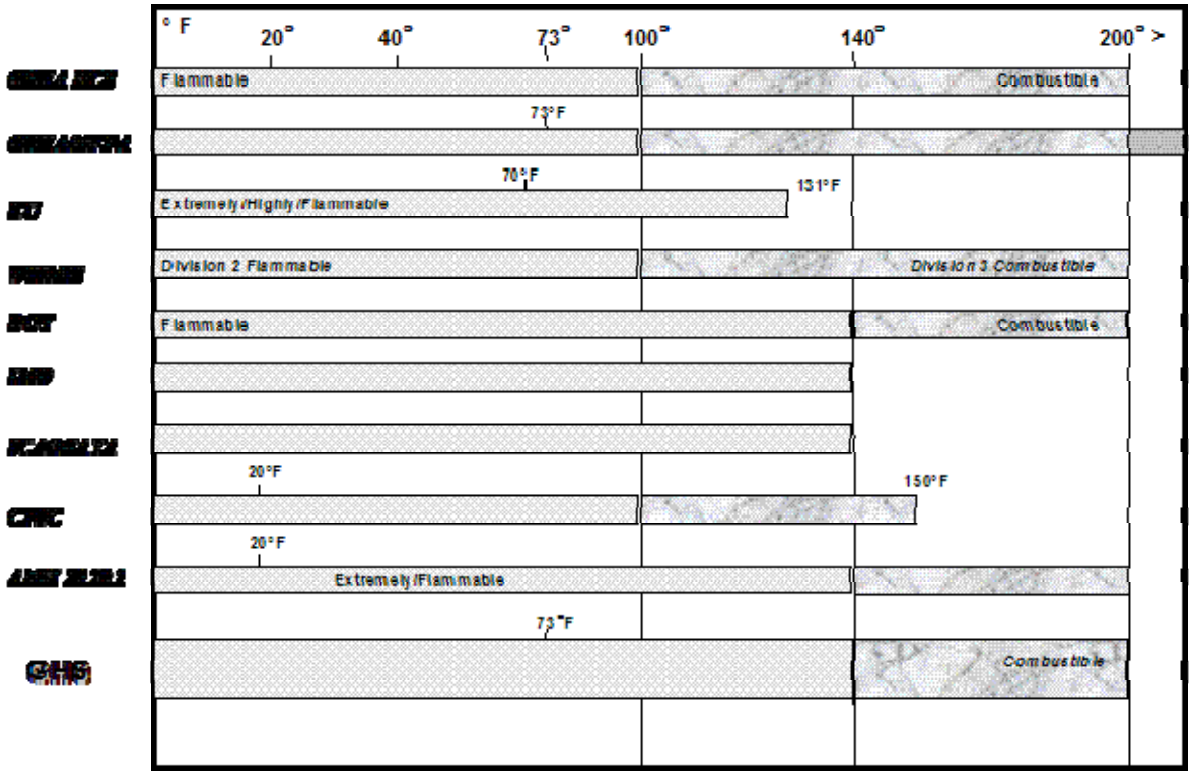
The numerical values on the hazard index scale in the table are not to scale.

For example, a product may be considered flammable or toxic by one agency or country, but not by another.

We can see by comparing a few hazards how complex it is to comply with all domestic and global regulations. Acute oral toxicity (LD_{50}) is a good example (Figure 1.2). Although most existing systems cover acute toxicity, we can see in the figure that what is considered hazardous varies considerably. These differences allow the same product to be hazardous in one country/system and not in another. At the very least, the same product has different labels and SDSs.

Figure 1.3

FLAMMABILITY



The numerical values on the hazard index scale in the table are not to scale.

Text Version of Chart:

Title: FLAMMABILITY
Type: Bar line graph by Fahrenheit degree from 0 degrees to 200 degrees with ten chart segments.

Chart data:

- OSHA HCS

  Flammable = 0-100 Degrees

  Combustible = 100-200 degrees

- OSHA/NFPA

  Flammable = 0-100 Degrees

  Combustible = 100-200+ degrees

- EU

  Extremely/Highly/Flammable = 0-131 Degrees

- WHMIS

  Division 2 Flammable = 0-100 Degrees

  Division 3 Combustible = 100-200 degrees

- DOT

  Flammable = 0-140 Degrees

  Combustible = 140-200 degrees

- IMO

  Flammable = 0-140 Degrees

- ICAO/IATA

  Flammable = 0-140 Degrees

- CPSC

  Flammable = 0-100 Degrees

  Combustible = 100-150 degrees

- ANSI Z129.1

  Extremely Flammable = 0-140 Degrees

  Combustible = 140-200 degrees

- GHS

  Flammable = 0-140 Degrees

  Combustible = 140-200 degrees

Flammable liquid is another hazard that is covered by most existing systems. As shown in Figure 1.3, the coverage varies between existing systems within the U.S. and globally. This means that the same product can be non-hazardous or hazardous with different labels/SDSs. In Section 4, Figures 4.1 through 4.7 show the diverse domestic and international labels for a fictitious product (ToxiFlam) which has both oral toxicity and flammability hazards.

These differences in hazards and SDS/labels impact both protection and trade. In the area of protection, users may see different label warnings or safety data sheet information for the same chemical. In the area of trade, the need to comply with multiple regulations regarding hazard classification and labeling is costly and time-consuming.

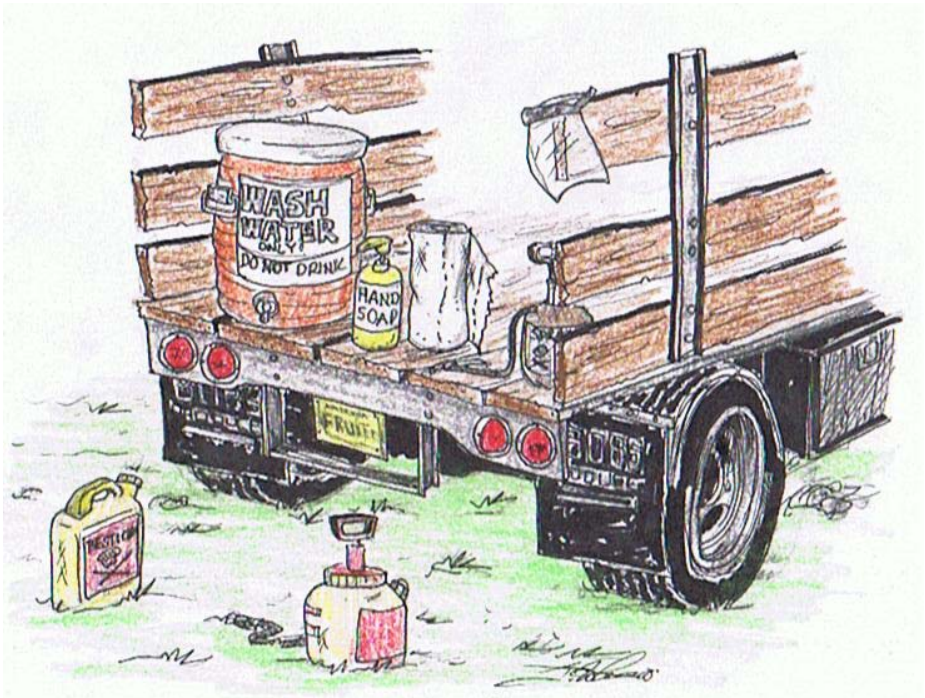
Some multinational companies have estimated that there are over 100 diverse hazard communication regulations for their products globally. For small and medium size enterprises (SMEs) regulatory compliance is complex and costly, and it can act as a barrier to international trade in chemicals.

1.3 What was the International Mandate?

Figure 1.4
International mandate from UNCED Agenda 21, Chapter 19
"A globally harmonized hazard classification and compatible labeling system, including material safety data sheets and easily understandable symbols, should be available, if feasible, by the year 2000."

The single most important force that drove the creation of the GHS was the international mandate (Figure 1.4) adopted in the 1992 United Nations Conference on Environment and Development (UNCED), often called the "Earth Summit".

The harmonization of classification and labeling of chemicals was one of six program areas that were endorsed by the United Nations General Assembly to strengthen international efforts concerning the environmentally sound management of chemicals. It was recognized that an internationally harmonized approach to classification and labeling would provide the foundation for all countries to develop comprehensive national programs to ensure the safe use of chemicals.



LETHAL DOSE 50 (LD50): A single dose of a material expected to kill 50 percent of a group of test animals. The dose is expressed as the amount per unit of body weight, the most common expression being milligrams of material per kilogram of body weight (mg/kg of body weight). Usually refers to oral or skin exposure.

1.4 How was the GHS developed?
In conjunction with its Convention and Recommendation on Safety in the Use of Chemicals at Work, the International Labor Organization (ILO) studied the tasks required to achieve harmonization. The ILO concluded that there were four major existing systems that needed to be harmonized to achieve a global approach.

No international organization covers all aspects of chemical classification and labeling. A broad scope and extensive expertise and resources were required to develop a system. In order to proceed, several decisions were needed:

(a) what systems would be considered "major" and thus the basis for harmonization, and (b) how could the work be divided to get the best expertise for different aspects. Four existing systems (Figure #1.5) were deemed to be major and the primary basis for the GHS. While not considered major, requirements of other systems were examined as appropriate, and taken into account as proposals were developed.

Figure 1.5
Existing Systems Included in the Harmonization Process

- UN Transport Recommendations
- U.S. Requirements for Workplace, Consumer and Pesticides
- European Union Dangerous Substance and Preparations Directives
- Canadian Requirements for Workplace, Consumers and Pesticides

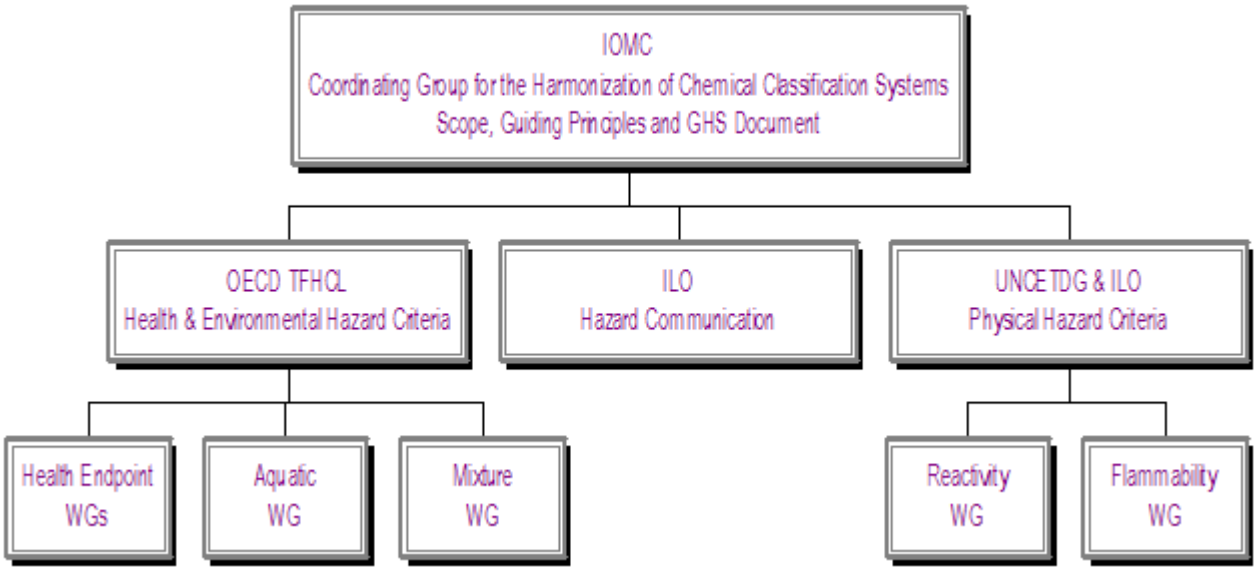
A Coordinating Group for the Harmonization of Chemical Classification Systems (CG/HCCS) was created under the Inter-organization Program for the Sound Management of Chemicals (IOMC) and they were charged with coordinating and managing development of the system. The GC/HCCS worked on a consensus basis and included representatives from major stakeholders, including national governments, industry and workers. They created a set of guiding principles (Figure 1.6). The scope and guiding principles created a common framework for the organizations that were charged with developing the different elements of the system.

Figure 1.6
Key Guiding Principles of the Harmonization Process

- Protection will not be reduced
- Will be based on intrinsic properties (hazards) of chemicals
- All types of chemicals will be covered
- All systems will have to be changed
- Involvement of all stakeholders should be ensured
- Comprehensibility must be addressed

In order to get the best expertise and resources, the work was divided among three technical focal points. Figure 1.7 shows how the work was assigned to the three technical focal points and the overall responsibilities of the Coordinating Group itself. The UN Committee of Experts on Transport of Dangerous Goods was selected as the lead for work on physical hazards, in cooperation with the ILO. Based on their work in the testing guidelines and other chemical issues, the Organization for Economic Cooperation and Development (OECD) was selected for health/environmental hazards and mixtures. ILO has a long history in MSDS/labels, and was selected to be the lead in hazard communication. The OECD and ILO groups also included representatives from governments, industry and workers.

Figure 1.7



Text Version of Flowchart:

IOMC
Coordinating Group for the Harmonization of Chemical Classification Systems
Scope, Guiding Principles and GHS Document

- OECD TFHCL Health & Environmental Hazard Criteria
  - Health Endpoint WGs
  - Aquatic WGs
  - Mixture WGs
- ILO Hazard Communication
- UNCE TDG & ILO Physical Hazard Criteria
  - Reactivity WGs
  - Flammability WGs

1.5 How will the GHS be maintained and updated?
In October 1999, the United Nations Economic and Social Council decided (resolution 1999/65) to enlarge the mandate of the Committee of Experts on the Transport of Dangerous Goods by reconfiguring it into a Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and labeling of Chemicals (UNCETDG/GHS). At the same time, a new Sub-Committee of Experts on the Globally Harmonized System of Classification and labeling of Chemicals (GHS Sub-Committee) was also created.

When the IOMC completed developing the GHS, the system was presented to the UN GHS Sub-Committee, which formally adopted the system at its first session in December 2002. It was subsequently endorsed by the UNCETDG/GHS. The UN Economic and Social Council endorsed the GHS in July 2003.

The Sub-Committee of Experts on the Globally Harmonized System of Classification will:

- Act as custodian of the system, managing and giving direction to the harmonization process,
- Keep the system up-to-date, as necessary, considering the need to introduce changes or updates to ensure its continued relevance,
- Promote understanding and use of the system and encourage feedback,
- Make the system available for worldwide use,
- Make guidance available on the application of the system, and on the interpretation and use of technical criteria to support consistency of application,
- Prepare work programs and submit recommendations to the UNCETDG/GHS.

1.6 When will the GHS be implemented?
There is no international implementation schedule for the GHS. It is likely that different national systems/sectors will require different timeframes for GHS implementation. Existing systems will need to consider phase-in strategies for transition from their current requirements to the new GHS requirements.

Several international bodies have proposed implementation goals. The World Summit on Sustainable Development (WSSD) and the Intergovernmental Forum for Chemical Safety (IFCS) have encouraged countries to implement the new GHS as soon as possible with a view to having the system fully operational by 2008. The Ministers of the Asia-Pacific Economic Cooperation (APEC) have also said that as many APEC economies as possible should implement, on a voluntary basis, the GHS by 2006. Under the North American Free Trade Agreement (NAFTA), the Tri-national Occupational Safety and Health Group and the NAFTA Pesticides Technical Working Group are discussing the GHS.

Some of the major existing systems have begun discussions about GHS implementation and situational analyses comparing existing requirements to GHS requirements. Some countries are considering harmonization to the greatest extent possible between their national sectors.

1.7 What are the benefits?
The basic goal of hazard communication is to ensure that employers, employees and the public are provided with adequate, practical, reliable and comprehensible information on the hazards of chemicals, so that they can take effective preventive and protective measure for their health and safety. Thus, implementation of effective hazard communication provides benefits for **governments**, **companies**, **workers**, and **members of the public**.

The GHS has maximum value if it is accepted in all major regulatory systems for chemical hazard communication. The diversity of hazard definitions is shown in Figures 1.2 and 1.3. The array of domestic and global labels for one product is shown in Figures 4.1 to 4.7. In the USA implementation of the GHS would harmonize hazard definitions and label information among U.S. regulatory agencies (CPSC, DOT, EPA, OSHA, etc.). If the GHS is implemented globally, consistent information will be communicated on labels and SDSs.

It is anticipated that application of the GHS will:
- Enhance the protection of human health and the environment by providing an internationally comprehensible system,
- Provide a recognized framework to develop regulations for those countries without existing systems,
- Facilitate international trade in chemicals whose hazards have been identified on an international basis,
- Reduce the need for testing and evaluation against multiple classification systems.

The tangible benefits to **governments** are:
- Fewer chemical accidents and incidents,
- Lower health care costs,
- Improved protection of workers and the public from chemical hazards,
- Avoiding duplication of effort in creating national systems,
- Reduction in the costs of enforcement,
- Improved reputation on chemical issues, both domestically and internationally.

Benefits to **companies** include:
- A safer work environment and improved relations with employees,
- An increase in efficiency and reduced costs from compliance with hazard communication regulations,
- Application of expert systems resulting in maximizing expert resources and minimizing labor and costs,
- Facilitation of electronic transmission systems with international scope,
- Expanded use of training programs on health and safety,

- Reduced costs due to fewer accidents and illnesses,
- Improved corporate image and credibility.

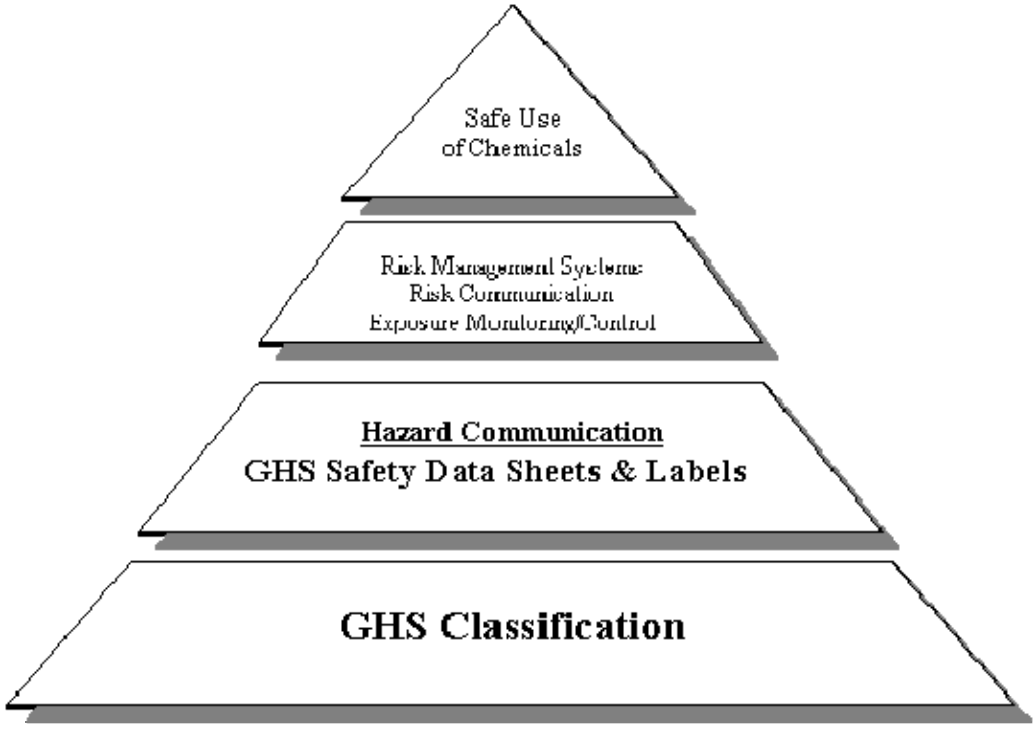
Benefits to **workers** and **members of the public** include:

- Improved safety for workers and others through consistent and simplified communications on chemical hazards and practices to follow for safe handling and use,
- Greater awareness of hazards, resulting in safer use of chemicals in the workplace and in the home.

2.0 How is the GHS to be applied?

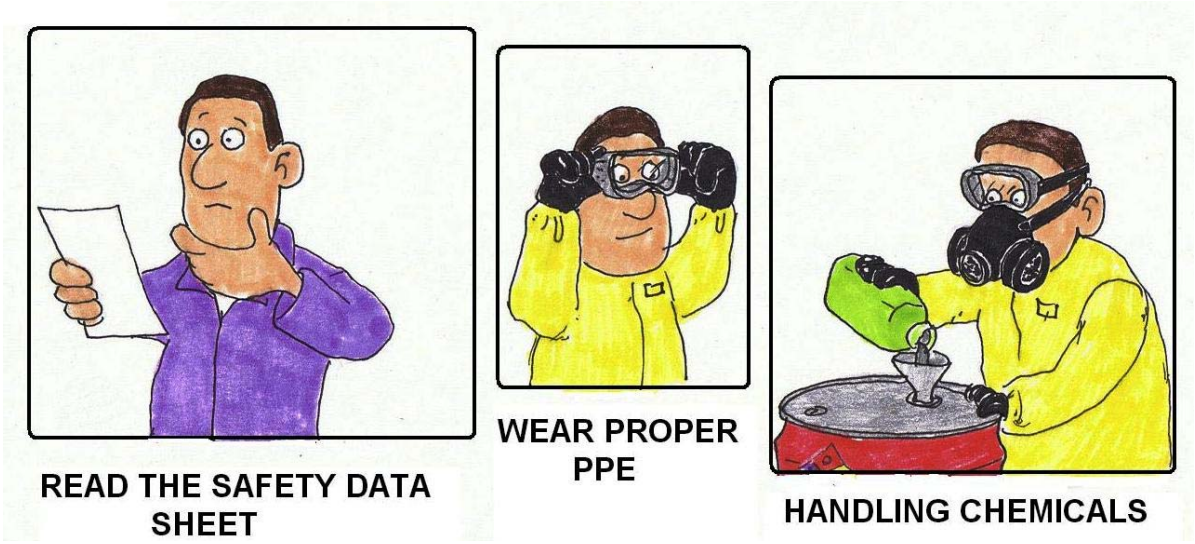
The GHS Classification and Communication elements are the foundation of programs to ensure the safe use of chemicals, as shown in Figure 2.1. The first two steps in any program to ensure the safe use of chemicals are to identify intrinsic hazard(s) (i.e., classification) and then to communicate that information. The design of the GHS communication elements reflect the different needs of various target audiences, such as workers and consumers. To proceed further up the pyramid, some existing national programs also include risk management systems as part of an overall program on the sound management of chemicals. The general goal of these systems is to minimize exposure, resulting in reduced risk. The systems vary in focus and include activities such as establishing exposure limits, recommending exposure monitoring methods and creating engineering controls. However, the target audiences of such systems are generally limited to workplace settings. With or without formal risk management systems, the GHS is designed to promote the safe use of chemicals.

Figure 2.1



2.1 Are all chemicals covered by the GHS?
The GHS covers all hazardous chemicals. There are no complete exemptions from the scope of the GHS for a particular type of chemical or product. The term "chemical" is used broadly to include substances, products, mixtures, preparations, or any other terms that may be used by existing systems. The goal of the GHS is to identify the intrinsic hazards of chemical substances and mixtures and to convey hazard information about these hazards. The GHS is not intended to harmonize risk assessment procedures or risk management decisions, as described above.

"Articles" as defined in the OSHA Hazard Communication Standard (HCS) (29 CFR 1910.1200), or by similar definitions, are outside the scope of the GHS. Chemical inventory (e.g., TSCA, EINECS, etc.) and chemical control requirements in various countries are not harmonized by the GHS. Classification in the GHS is criteria-based, not limiting coverage to a list that can become outdated. It is not anticipated that the GHS will develop or maintain an international classification authority or international classification list. Several countries currently maintain regulatory lists. GHS classification criteria can be used to reclassify chemicals on lists, if desired. Existing lists, such as those provide by organizations that evaluate cancer hazards, could be used in conjunction with the GHS to promote harmonization.



2.2 Will all hazardous chemicals require a GHS label and Safety Data Sheet?

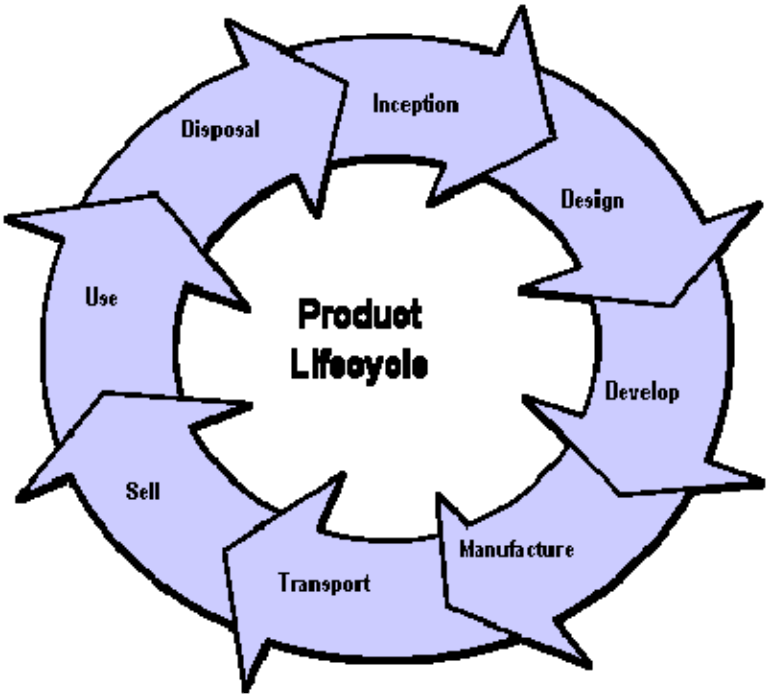


Figure 2.2

The need for GHS labels and/or Safety Data Sheets is expected to vary by product ca
from research/production to end use. The sequence of lifecycle events is shown in Fig
additives, cosmetics and pesticide residues in food will **not** be covered by the GHS at
where workers may be exposed (workplaces), and in transport. Also, the medical use
generally addressed in package inserts and is not part of existing hazard communicat
not labeled under existing hazard communication systems. The exact requirements fo
to be defined in national regulations. However, national requirements are expected to
scope provided in **Chapter 1.1 of the GHS document**.

2.3 How will the GHS impact existing regulations?
The GHS is a voluntary international system that imposes no binding treaty obligations on countries. To the extent that countries adopt the GHS into their systems, the regulatory changes would be binding for covered industries. For countries with existing systems, it is expected that the GHS components will be applied within the framework/infrastructure of existing hazard communication regulatory schemes. For example, exceptions and exemptions found in existing regulations would not be expected to change (e.g., transportation of limited quantities).

However, the specific hazard criteria, classification processes, label elements and SDS requirements within an existing regulation will need to be modified to be consistent with the harmonized elements of the GHS. It is anticipated that **ALL** existing hazard communication systems will need to be changed in order to apply the GHS. For example, in the U.S. EPA and OSHA would be expected to require hazard pictograms/symbols on labels. Canada and the EU would be expected to adopt the GHS pictograms/symbols instead of those currently in use. The transport sector is expected to adopt the changed criteria (LD_{50}/LC_{50}) for the GHS Acute Toxicity Categories 1 - 3. OSHA HCS, WHMIS and the EU would all need to change their acute toxicity criteria.

Test data already generated for the classification of chemicals under existing systems should be accepted when classifying these chemicals under the GHS, thereby avoiding duplicative testing and the unnecessary use of test animals.

2.4 What is meant by GHS Building Blocks?
The GHS classification and communication requirements can be thought of as a collection of building blocks. In regulatory schemes, coverage and communication of hazards vary by the needs of target audiences/sectors. Accordingly, the GHS was designed to contain the hazard endpoints and communication tools necessary for application to known regulatory schemes. The GHS is structured so that the appropriate elements for classification and communication, which address the target audiences, can be selected.

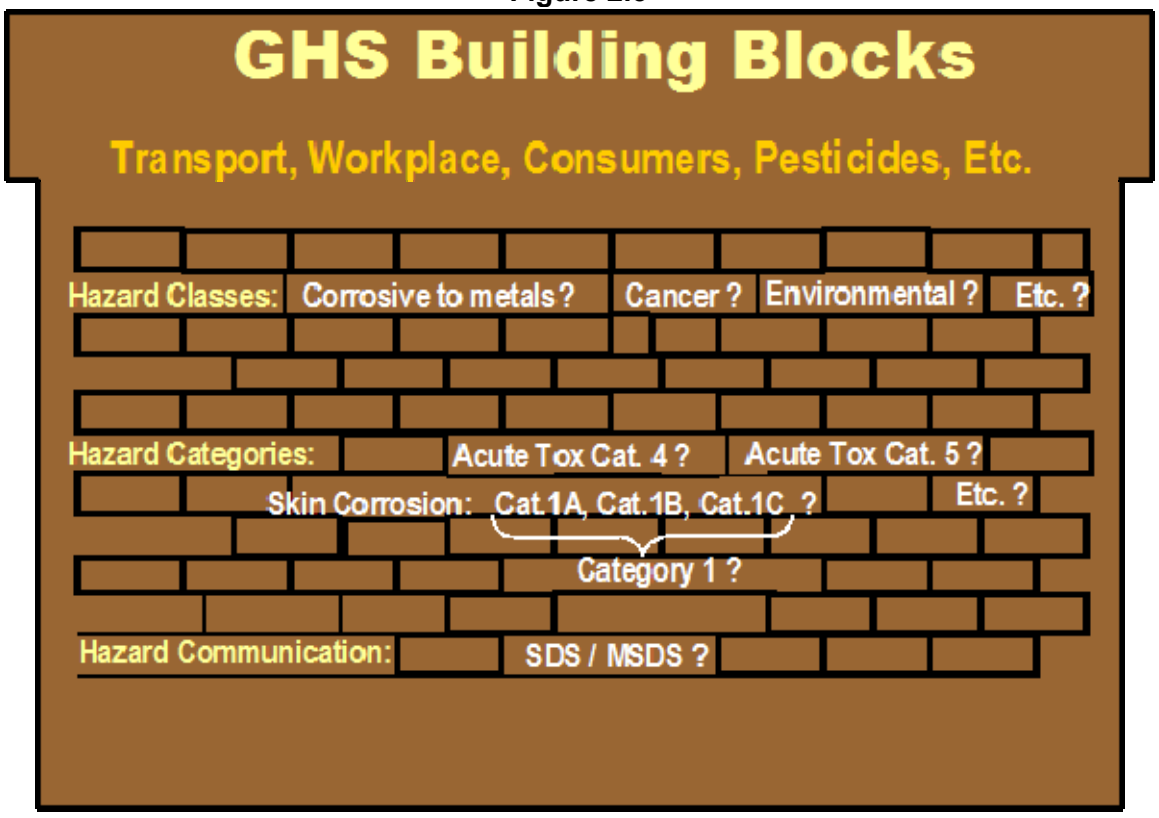
The full range of harmonized elements is available to everyone, and should be used if a country or organization chooses to cover a certain effect when it adopts the GHS. The full range of these elements does not have to be adopted. Countries can determine which of the building blocks will be applied in different parts of their systems (consumer, workplace, transport, pesticides, etc.). For example, some options for implementing the GHS include:

- Not using a GHS class (e.g., cancer, hazardous to the aquatic environment, etc.);
- Not using a GHS category (normally at the beginning or end of a class, e.g., Acute Toxicity Cat. 5);
- Combining categories (e.g., Acute Toxicity Cat.# 1 and Cat.# 2; Skin Corrosion Cat.1A, 1B and 1C).

2.5 How should the GHS Building Blocks by applied?
Appropriate implementation of the GHS means that the hazards covered by a Competent Authority (CA) are covered consistently with the GHS criteria and requirements. The EPA, Health Canada and OSHA are examples of Competent Authorities. Competent Authorities will decide how to apply the various elements of the GHS based on the CA needs and the needs of target audiences.

When a regulatory scheme covers something that is in the GHS, and implements the GHS, that coverage should be consistent. Once an endpoint and subclasses are selected, as needed, the GHS classification criteria, assigned label elements and SDS provisions should be followed as specified in the GHS. If a regulatory system covers carcinogenicity, for example, it should follow the harmonized classification scheme, the harmonized label elements and, where appropriate, the SDS. Figure 2.3 shows some of the hazard endpoint/subcategory and hazard communication building block choices for the transport, workplace, consumer and pesticide sectors.

Figure 2.3



To gain a better understanding of the building block approach, it is helpful to look at the specific sectors/target audiences. The needs and regulations of the various sectors vary depending on the type of chemical and use pattern. Different target audiences or sectors receive and use hazard information in different ways. The primary sectors/target audiences are transport, workplace, consumers and agriculture (pesticides). These sectors are described in more detail below.

2.5.1 Transport

For transport, it is expected that application of the GHS will be similar to application of current transport requirements.

- GHS physical, acute and environmental hazard criteria are expected to be adopted in the transport sector.
- Containers of dangerous goods will have pictograms that address acute toxicity, physical hazards, and environmental hazards.
- GHS hazard communication elements such as signal words, hazard statements and SDS are not expected to be adopted in the transport sector.

2.5.2 Workplace

In the workplace, it is expected that most of the GHS elements will be adopted, including;·

- GHS physical and health hazard criteria, as appropriate;
- Labels that have the harmonized core information under the GHS (signal words, hazard statements and symbols, etc.);
- Safety Data Sheets;
- Employee training to help ensure effective communication is also anticipated;

All workplace systems may not have the jurisdiction to adopt environmental hazards.

2.5.3 Consumer

For the consumer sector, it is expected that labels will be the primary focus of GHS application.·

- The appropriate GHS hazard criteria are expected to be adopted;
- These labels will include the core elements of the GHS (signal words, hazard statements and symbols, etc.), subject to some sector-specific considerations in certain systems (e.g., risk-based labeling).

2.5.4 Pesticides

For pesticides, it is expected that the GHS will be adopted.

- The appropriate GHS hazard criteria are expected to be adopted;
- Pesticide labels will include the core elements of the GHS (signal words, hazard statements and symbols, etc.), subject to some sector-specific considerations in certain systems.

2.6 How will the GHS impact countries without existing regulations?
Developing and maintaining a classification and labeling system is not a simple task. The GHS can be used as a tool for developing national regulations. It is expected that countries that do not have systems will adopt GHS as their basic scheme. The GHS provides the building blocks from which countries can construct chemical safety programs. Although the GHS will facilitate the process, many challenges exist in creating new regulations. For example:

- What is the appropriate legal framework for adopting/implementing the GHS?
- What government agencies should be involved? Are there ministries/agencies ready to implement and maintain the GHS?
- How will stakeholder cooperation and support for implementing the GHS be managed?

Work has begun in international organizations (e.g., UNITAR and ILO) under the guidance of the UN GHS Sub-Committee, to develop technical assistance for developing countries to write new regulations using the GHS elements. Guidance has been developed on how to implement a national GHS action plan. Additionally, pilot implementations have begun in a few countries. The opportunities and challenges learned from the pilot programs will be documented and are expected to facilitate future implementations.

3.0 What is Classification?
Classification is the starting point for hazard communication. It involves the identification of the hazard(s) of a chemical or mixture by assigning a category of hazard/danger using defined criteria. The GHS is designed to be consistent and transparent. It draws a clear distinction between classes and categories in order to allow for **"self-classification"**. For many hazards a decision tree approach (e.g., eye irritation) is provided in the GHS Document. For several hazards the GHS criteria are semi-quantitative or qualitative. Expert judgment may be required to interpret these data.

Figure 3.1
Hazard Classification

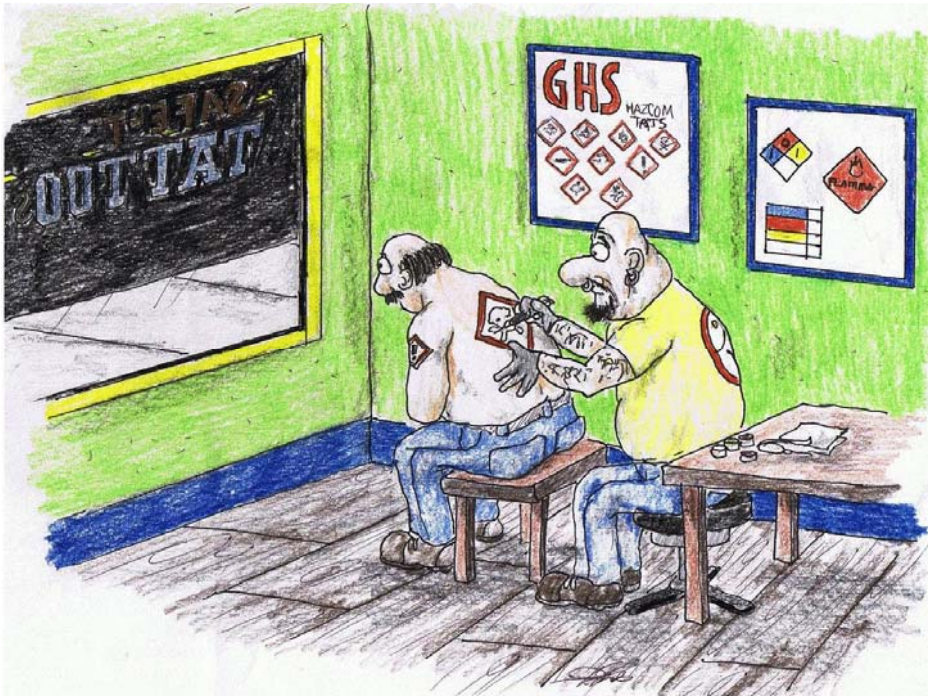
The term "hazard classification is used to indicate that only the intrinsic hazardous properties of substances and mixtures are considered and involves the following 3 steps:

a) Identification of relevant data regarding the hazards of a substance or mixture;
b) Subsequent review of those data to ascertain the hazards associated with the substance or mixture; and
c) A decision on whether the substance or mixture will be classified as a hazardous substance or mixture and the degree of hazard, where appropriate, by comparison of the data with agreed hazard classification criteria.

Figure 3.1 shows the harmonized definition for hazard classification, which can be applied to all hazard categories in the system.

The data used for classification may be obtained from tests, literature, and practical experience. The GHS health and environmental hazard criteria/definitions are test method neutral. Accordingly, tests that determine hazardous properties conducted according to internationally recognized scientific principles can be used for purposes of hazard classification.

The GHS endpoints that cover physical, health and environmental hazards are listed in Figures 3.2 and 3.3, respectively. As mentioned earlier, the GHS hazard definitions are criteria-based. The following information provides an overview of the GHS definitions and classification criteria. It is recommended that the person responsible for GHS implementation consult the GHS Document or "Purple Book" for more complete information.



3.1 What are the GHS Physical Hazards?

The GHS physical hazards criteria, developed by the ILO and UNCETDG, were largely based on the existing criteria used by the UN Model Regulation on the Transport of Dangerous Goods. Therefore, many of the criteria are already being used on a worldwide basis. However, some additions and changes were necessary since the scope of the GHS includes all target audiences. The physical hazards classification process provides specific references to approved test methods and criteria for classification. The GHS physical hazard criteria apply to mixtures. It is assumed that mixtures will be tested for physical hazards.

In general, the GHS criteria for physical hazards are quantitative or semi-quantitative with multiple hazard levels within an endpoint. This is different from several of the existing systems that currently have qualitative criteria for various physical hazards (e.g., organic peroxide criteria under WHMIS and OSHA HCS). This could make classification under the GHS more consistent.

In developing GHS criteria for physical hazards it was necessary to define physical states. In the GHS,

- a **gas** is a substance or mixture which at 50°C has a vapor pressure greater than 300 kPa; or is completely gaseous at 20°C and a standard pressure of 101.3 kPa.

- a **liquid** is a substance or mixture that is not a gas and which has a melting point or initial melting point of 20°C or less at standard pressure of 101.3 kPa.

- a **solid** is a substance or mixture that does not meet the definitions of a liquid or a gas.

The GHS physical hazards are briefly described below. For many of the physical hazards the GHS Document contains Guidance Sections with practical information to assist in applying the criteria.

Figure 3.2
Physical Hazard

- Explosives
- Flammable Gases
- Flammable Aerosols
- Oxidizing Gases
- Gases Under Pressure
- Flammable Liquids
- Flammable Solids
- Self-Reactive Substances
- Pyrophoric Liquids
- Pyrophoric Solids
- Self-Heating Substances
- Substances which, in contact with water emit flammable gases
- Oxidizing Liquids
- Oxidizing Solids
- Organic Peroxides
- Corrosive to Metals

3.1.1 Explosives

An explosive substance (or mixture) is a solid or liquid which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases. A pyrotechnic substance (or mixture) is designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic chemical reactions.

Classification as an explosive and allocation to a division is a three-step process:

- Ascertain if the material has explosive effects (Test Series 1);
- Acceptance procedure (Test Series 2 to 4);
- Assignment to one of six hazard divisions (Test Series 5 to 7).

Table 3.1 Explosives

Division	Characteristics
1.1	Mass explosion hazard
1.2	Projection hazard
1.3	Fire hazard or minor projection hazard
1.4	No significant hazard
1.5	Very insensitive substances with mass explosion hazard
1.6	Extremely insensitive articles with no mass explosion hazard

Explosive properties are associated with certain chemical groups that can react to give very rapid increases in temperature or pressure. The GHS provides a screening procedure that is aimed at identifying the presence of such reactive groups and the potential for rapid energy release. If the screening procedure identifies the substance or mixture to be a potential explosive, the acceptance procedure has to be performed.

Substances, mixtures and articles are assigned to one of six divisions, 1.1 to 1.6, depending on the type of hazard they present. See, *UN Manual of Tests and Criteria* Part I Test Series 2 to 7. Currently, only the transport sector uses six categories for explosives.

3.1.2 Flammable Gases

Flammable gas means a gas having a flammable range in air at 20°C and a standard pressure of 101.3 kPa. Substances and mixtures of this hazard class are assigned to one of two hazard categories on the basis of the outcome of the test or calculation method (ISO 10156:1996).

3.1.3 Flammable Aerosols

Aerosols are any gas compressed, liquefied or dissolved under pressure within a non-refillable container made of metal, glass or plastic, with or without a liquid, paste or powder. The container is fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid or gaseous state.

Aerosols should be considered for classification as either a Category 1 or Category 2 Flammable Aerosol if they contain any component classified as flammable according to the GHS criteria for flammable liquids, flammable gases, or flammable solids.

Classification is based on:

- Concentration of flammable components;
- Chemical heat of combustion (mainly for transport/storage);
- Results from the foam test (foam aerosols) (mainly for worker/consumer);
- Ignition distance test (spray aerosols) (mainly for worker/consumer);
- Enclosed space test (spray aerosols) (mainly for worker/consumer).

Aerosols are considered:

- Nonflammable, if the concentration of the flammable components $\leq$ 1% and the heat of combustion is < 20 kJ/g.
- Extremely flammable, if the concentration of the flammable components >85% and the heat of combustion is $\geq$ 30 kJ/g to avoid excessive testing.

See the *UN Manual of Tests and Criteria* for the test method.

3.1.4 Oxidizing Gases

Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis that, generally by providing oxygen, they cause or contribute to the combustion of other material more than air does. The test method is ISO 10156:1996. Currently, several workplace hazard communication systems cover oxidizers (solids, liquids, gases) as a class of chemicals.

3.1.5 Gases under Pressure

Gases under pressure are gases that are contained in a receptacle at a pressure not less than 280 Pa at 20°C or as a refrigerated liquid. This endpoint covers four types of gases or gaseous mixtures to address the effects of sudden release of pressure or freezing which may lead to serious damage to people, property, or the environment independent of other hazards the gases may pose.

For this group of gases, the following information is required:

- vapor pressure at 50°C;
- physical state at 20°C at standard ambient pressure;
- critical temperature.

Criteria that use the physical state or compressed gases will be a different classification basis for some workplace systems.

Table 3.2 Gases under Pressure

Group	Criteria
Compressed gas	Entirely gaseous at -50°C
Liquefied gas	Partially liquid at temperatures > -50°C
Refrigerated liquefied gas	Partially liquid because of its low temperature
Dissolved gas	Dissolved in a liquid phase solvent

Data can be found in the literature, and calculated or determined by testing. Most pure gases are already classified in the UN Model Regulations. Gases are classified, according to their physical state when packaged, into one of four groups as shown in Table 3.2.

3.1.6 Flammable Liquids

Flammable liquid means a liquid having a flash point of not more than 93°C. Substances and mixtures of this hazard class are assigned to one of four hazard categories on the basis of the flash point and boiling point (See Table 3.3). Flash Point is determined by closed cup methods as provided in the GHS document, Chapter 2.5, paragraph 11.

Table 3.3 Flammable Liquids

Category	Criteria
1	Flash point < 23°C and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C and ≤ 60°C (140°F)
4	Flash point ≥ 60°C (140°F) and ≤ 93°C (200°F)

3.1.7 Flammable Solids

Flammable solids are solids that are readily combustible, or may cause or contribute to fire through friction. Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

Substances and mixtures of this hazard class are assigned to one of two hazard categories (Table 3.4) on the basis of the outcome of the UN Test N.1 (*UN Manual of Tests and Criteria*). The tests include burning time, burning rate and behavior of fire in a wetted zone of the test sample.

Table 3.4 Flammable Solids

Category	Criteria
1	Metal Powders: burning time ≤ 5 minutes Others: wetted zone does not stop fire & burning time < 45 seconds or burning > 2.2 mm/second
2	Metal Powders: burning time > 5 and ≤ 10 minutes Others: wetted zone stop fire for at least 4 minutes & burning time < 45 seconds or burning rat > 2.2mm/second

3.1.8 Self-Reactive Substances

Self-reactive substances are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air). This definition excludes materials classified under the GHS as explosive, organic peroxides or as oxidizing. These materials may have similar properties, but such hazards are addressed in their specific endpoints. There are exceptions to the self-reactive classification for material: (i) with heat of decomposition <300 J/g or (ii) with self-accelerating decomposition temperature (SADT) > 75°C for a 50 kg package.

Substances and mixtures of this hazard class are assigned to one of the seven 'Types', A to G, on the basis of the outcome of the UN Test Series A to H (*UN Manual of Tests and Criteria*). Currently, only the transport sector uses seven categories for self-reactive substances (Table 3.5).

Table 3.5 Self-Reactive Substances

Type	Criteria
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates, but is liable to undergo a thermal explosion in that package.
C	Possess explosive properties when the substance or mixture as package cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or ▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or ▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.
G	Neither detonates in the cavitated state nor deflagrates at all and shows non effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

Pyrophorics

3.1.9 Pyrophoric Liquids

A pyrophoric liquid is a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis of the outcome of the UN Test N.3 (UN Manual of Tests and Criteria).

3.1.10 Pyrophoric Solids

A pyrophoric solid is a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis of the outcome of the UN Test N.2 (*UN Manual of Tests and Criteria)*.

3.1.11 Self-Heating Substances

A self-heating substance is a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat. This endpoint differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days). Substances and mixtures of this hazard class are assigned to one of two hazard categories on the basis of the outcome of the UN Test N.4 (*UN Manual of Tests and Criteria)*.

3.1.12 Substances which on Contact with Water Emit Flammable Gases

Substances that, in contact with water, emit flammable gases are solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test N.5 *UN Manual of Tests and Criteria*) which measure gas evolution and speed of evolution.

Table 3.6 Substances which on Contact with Water Emit Flammable Gases

Category	Criteria
1	≥10 L/kg/1 minute
2	≥20 L/kg/ 1 hour + < 10 L/kg/1 min
3	≥1 L/kg/1 hour + < 20 L/kg/1 hour
Not classified	< 1 L/kg/1 hour

3.1.13 Oxidizing Liquids

An oxidizing liquid is a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test O.2 *UN Manual of Tests and Criteria*) which measure ignition or pressure rise time compared to defined mixtures.

3.1.14 Oxidizing Solids

An oxidizing solid is a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test O.1 *UN Manual of Tests and Criteria*) which measure mean burning time and re compared to defined mixtures. Currently, several workplace hazard communication systems cover oxidizers (solids, liquids, gases) as a class of chemicals.

3.1.15 Organic Peroxides

An organic peroxide is an organic liquid or solid which contains the bivalent -0-0- structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulations (mixtures). Such substances and mixtures may:

- be liable to explosive decomposition;
- burn rapidly;
- be sensitive to impact or friction;
- react dangerously with other substances.

Substances and mixtures of this hazard class are assigned to one of seven 'Types', A to G, on the basis of the outcome of the UN Test Series A to H (*UN Manual of Tests and Criteria*). Currently, only the transport sector uses seven categories for organic peroxides.

Table 3.7 Organic Peroxides

Type	Criteria
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package.
C	Possess explosive properties when the substance or mixture as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or ▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or ▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the caviated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinements as well as low or non explosive power.
G	Neither detonates in the caviated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

3.1.16 Substances Corrosive to Metal

A substance or a mixture that by chemical action will materially damage, or even destroy, metals is termed 'corrosive to metal'. These substances or mixtures are classified in a single hazard category on the basis of tests (Steel: ISO 9328 (II): 1991 - Steel type P235; Aluminum: ASTM G31-72 (1990) - non-clad types 7075-T6 or AZ5GU-T66). The GHS criteria are a corrosion rate on steel or aluminum surfaces exceeding 6.25 mm per year at a test temperature of 55°C.

The concern in this case is the protection of metal equipment or installations in case of leakage (e.g., plane, ship, tank), not material compatibility between the container/tank and the product. This hazard is not currently covered in all systems.

3.2 What are the GHS Health and Environmental Hazards?

The GHS health and environmental hazard criteria represent a harmonized approach for existing classification systems (see Figure 3.3). The work at the OECD to develop the GHS criteria included:

- A thorough analysis of existing classification systems, including the scientific basis for a system and its criteria, its rationale and an explanation of the mode of use;
- A proposal for harmonized criteria for each category. For some categories the harmonized approach was easy to develop because the existing systems had similar approaches. In cases where the approach was different, a compromise consensus proposal was developed.
- Health and environmental criteria were established for substances and mixtures.

Figure 3.3
Health Hazard

- Acute Toxicity
- Skin Corrosion/Irritation
- Serious Eye Damage/Eye Irritation
- Respiratory or Skin Sensitization
- Germ Cell Mutagenicity
- Carcinogenicity
- Reproductive Toxicology
- Target Organ Systemic Toxicity - Single Exposure
- Target Organ Systemic Toxicity - Repeated Exposure
- Aspiration Toxicity

Environmental Hazard

- Hazardous to the Aquatic Environment

  Acute aquatic toxicity

  Chronic aquatic toxicity

  - Bioaccumulation potential
  - Rapid degradability

The GHS Health and Environmental Endpoints
The following paragraphs briefly describe the GHS health and environmental endpoints. The criteria for classifying substances are presented first. Then the GHS approach to classifying mixtures is briefly discussed. It is recommended that the person responsible for GHS implementation consult the GHS Document or "Purple Book" for more complete information.

3.2.1 Acute Toxicity
Five GHS categories have been included in the GHS Acute Toxicity scheme from which the appropriate elements relevant to transport, consumer, worker and environment protection can be selected. Substances are assigned to one of the five toxicity categories on the basis of LD_{50} (oral, dermal) or LC_{50} (inhalation). The LC_{50} values are based on 4-hour tests in animals. The GHS provides guidance on converting 1-hour inhalation test results to a 4-hour equivalent. The five categories are shown in the Table 3.8 Acute Toxicity.

Table 3.8 Acute Toxicity

Acute toxicity	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Category 5
Oral (mg/kg)	≤ 5	> 5 ≤ 50	> 50 ≤ 300	> 300 ≤ 2000	Criteria: ▪ Anticipated oral LD50 between 2000 and 5000 mg/kg; ▪ Indication of significant effect in humans;* ▪ Any mortality at class 4;* ▪ Significant clinical signs at class 4;* ▪ Indications from other studies.* *If assignment to more hazardous class is not warranted.
Dermal (mg/kg)	≤ 50	> 50 ≤ 200	> 200 ≤ 1000	> 1000 ≤ 2000	
Gases (ppm)	≤ 100	> 100 ≤ 500	> 500 ≤ 2500	> 2500 ≤ 5000	
Vapors (mg/l)	≤ 0.5	> 0.5 ≤ 2.0	> 2.0 ≤ 10	> 10 ≤ 20	
Dust & mists (mg/l)	≤ 0.05	> 0.05 ≤ 0.5	> 0.5 ≤ 1.0	> 1.0 ≤ 5	

Category 1, the most severe toxicity category, has cut-off values currently used primarily by the transport sector for classification for packing groups. Some Competent Authorities may consider combining Acute Categories 1 and 2. Category 5 is for chemicals which are of relatively low acute toxicity but which, under certain circumstances, may pose a hazard to vulnerable populations. Criteria other than LD50/LC50 data are provided to identify substances in Category 5 unless a more hazardous class is warranted.

3.2.2 Skin Corrosion

Skin corrosion means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours. Substances and mixtures in this hazard class are assigned to a single harmonized corrosion category. For Competent Authorities, such as transport packing groups, needing more than one designation for corrosivity, up to three subcategories are provided within the corrosive category. See the Skin Corrosion/Irritation Table 3.9.

Several factors should be considered in determining the corrosion potential before testing is initiated:

- Human experience showing irreversible damage to the skin;
- Structure/activity or structure property relationship to a substance or mixture already classified as corrosive;
- pH extremes of less than 2 and more than 11.5 including acid/alkali reserve capacity.

Table 3.9 Skin Corrosion/Irritation

<table>
<tr><th colspan="3">Skin Corrosion
Category 1</th><th>Skin Irritation
Category 2</th><th>Mild Skin Irritation
Category 3</th></tr>
<tr><td colspan="3">Destruction of dermal tissue: visible necrosis in at least one animal</td><td rowspan="2">Reversible adverse effects in dermal tissue

Draize score: ≥ 2.3 < 4.0
or persistent inflammation</td><td rowspan="2">Reversible adverse effects in dermal tissue

Draize score: ≥ 1.5 < 2.3</td></tr>
<tr><td>Subcategory 1A
Exposure < 3 min.
Observation < 1hr,</td><td>Subcategory 1B
Exposure < 1hr.
Observation < 14 days</td><td>Subcategory 1C
Exposure < 4 hrs.
Observation < 14 days</td></tr>
</table>

3.2.3 Skin Irritation

Skin irritation means the production of reversible damage to the skin following the application of a test substance for up to 4 hours. Substances and mixtures in this hazard class are assigned to a single irritant category. For those authorities, such as pesticide regulators, wanting more than one designation for skin irritation, an additional mild irritant category is provided. See the Skin Corrosion/Irritation Table 3.9.

Several factors should be considered in determining the irritation potential before testing is initiated:

- Human experience or data showing reversible damage to the skin following exposure of up to 4 hours;
- Structure/activity or structure property relationship to a substance or mixture already classified as an irritant.

3.2.4 Eye Effects

Several factors should be considered in determining the *serious eye damage* or *eye irritation* potential before testing is initiated:

- Accumulated human and animal experience;
- Structure/activity or structure property relationship to a substance or mixture already classified;
- pH extremes like $\leq$ 2 and $\geq$ 11.5 that may produce serious eye damage.

Table 3.10 Eye Effects

Category 1 **Serious eye damage**	**Category 2** **Eye Irritation**	
Irreversible damage 21 days after exposure Draize score: Corneal opacity ≥ 3 Iritis > 1.5	Reversible adverse effects on cornea, iris, conjunctiva Draize score: Corneal opacity ≥ 1 Iritis > 1 Redness ≥ 2 Chemosis ≥ 2	
	Irritant Subcategory 2A Reversible in 21 days	**Mild Irritant** Subcategory 2B Reversible in 7 days

Serious eye damage means the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the front surface of the eye, which is not fully reversible within 21 days of application. Substances and mixtures in this hazard class are assigned to a single harmonized category.

Eye irritation means changes in the eye following the application of a test substance to the front surface of the eye, which are fully reversible within 21 days of application. Substances and mixtures in this hazard class are assigned to a single harmonized hazard category. For authorities, such as pesticide regulators, wanting more than one designation for eye irritation, one of two subcategories can be selected, depending on whether the effects are reversible in 21 or 7 days.

3.2.5 Sensitization

Respiratory sensitizer means a substance that induces hypersensitivity of the airways following inhalation of the substance. Substances and mixtures in this hazard class are assigned to one hazard category.

Skin sensitizer means a substance that will induce an allergic response following skin contact. The definition for "skin sensitizer" is equivalent to "contact sensitizer". Substances and mixtures in this hazard class are assigned to one hazard category. Consideration should be given to classifying substances which cause immunological contact urticaria (an allergic disorder) as contact sensitizers.

3.2.6 Germ Cell Mutagenicity

Mutagen means an agent giving rise to an increased occurrence of mutations in populations of cells and/or organisms. Substances and mixtures in this hazard class are assigned to one of two hazard categories. Category 1 has two subcategories. See the Germ Cell Mutagenicity (Table 3.11) below.

Table 3.11 Germ Cell Mutagenicity

<table>
<tr><th colspan="2">Category 1
Known/Presumed</th><th>Category 2
Suspected/Possible</th></tr>
<tr><td colspan="2">Known to produce heritable mutations in human germ cells</td><td rowspan="2">▪ May include heritable mutations in human germ cells
▪ Positive evidence from tests in mammals and somatic cell tests
▪ In vivo somatic genotoxicity supported by in vitro mutagenicity</td></tr>
<tr><td>Subcategory 1A
Positive evidence from epidemiological studies</td><td>Subcategory 1B
Positive results in:
▪ In vivo heritable germ cell tests in mammals
▪ Human germ cell tests
▪ In vivo somatic mutagenicity tests, combined with some evidence of germ cell mutagenicity</td></tr>
</table>

3.2.7 Carcinogenicity

Carcinogen means a chemical substance or a mixture of chemical substances which induce cancer or increase its incidence. Substances and mixtures in this hazard class are assigned to one of two hazard categories. Category 1 has two subcategories. The Carcinogenicity Guidance Section in the GHS Document includes comments about IARC.

Table 3.12 Carcinogenicity

<table>
<tr><th colspan="2">Category 1
Known or Presumed Carcinogen</th><th>Category 2
Suspected Carcinogen</th></tr>
<tr><td>Subcategory 1A
Known Human Carcinogen Based on human evidence</td><td>Subcategory 1B
Presumed Human Carcinogen
Based on demonstrated animal carcinogenicity</td><td>Limited evidence of human or animal carcinogenicity</td></tr>
</table>

3.2.8 Reproductive Toxicity

Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in offspring. Substances and mixtures with reproductive and/or developmental effects are assigned to one of two hazard categories, 'known or presumed' and 'suspected'. Category 1 has two subcategories for reproductive and developmental effects. Materials which cause concern for the health of breastfed children have a separate category, Effects on or Via Lactation.

Table 3.13 Reproductive Toxicity

<table>
<tr><th colspan="2">Category 1</th><th>Category 2
Suspected</th><th>Additional
Category</th></tr>
<tr><td colspan="2">Known or presumed to cause effects on human reproduction or on development</td><td rowspan="2">Human or animal evidence possibly with other information</td><td rowspan="2">Effects on or via lactation</td></tr>
<tr><td>Category 1A
Known
Based on human evidence</td><td>Category 1B
Presumed
Based on experimental animals</td></tr>
</table>

3.2.9 Target Organ Systemic Toxicity (TOST): Single Exposure & Repeated Exposure
The GHS distinguishes between single and repeat exposure for Target Organ Effects. Some existing systems distinguish between single and repeat exposure for these effects and some do not. All significant health effects, not otherwise specifically included in the GHS, that can impair function, both reversible and irreversible, immediate and/or delayed are included in the non-lethal target organ/systemic toxicity class (TOST). Narcotic effects and respiratory tract irritation are considered to be target organ systemic effects following a single exposure.

Substances and mixtures of the single exposure target organ toxicity hazard class are assigned to one of three hazard categories in Table 3.14.

Table 3.14 TOST: Single Exposure

Category 1	Category 2	Category 3
Significant toxicity in humans - Reliable, good quality human case studies or epidemiological studies Presumed significant toxicity in humans - Animal studies with significant and/or severe toxic effects relevant to humans at generally low exposure (guidance)	Presumed to be harmful to human health - Animal studies with significant toxic effects relevant to humans at generally moderate exposure (guidance) - Human evidence in exceptional cases	Transient target organ effects - Narcotic effects - Respiratory tract irritation

Substances and mixtures of the repeated exposure target organ toxicity hazard class are assigned to one of two hazard categories in Table 3.15.

Table 3.15 TOST: Repeated Exposure

Category 1	Category 2
Significant toxicity in humans - Reliable, good quality human case studies or epidemiological studies Presumed significant toxicity in humans - Animal studies with significant and/or severe toxic effects relevant to humans at generally low exposure (guidance)	Presumed to be harmful to human health - Animal studies with significant toxic effects relevant to humans at generally moderate exposure (guidance) - Human evidence in exceptional cases

In order to help reach a decision about whether a substance should be classified or not, and to what degree it would be classified (Category 1 vs. Category 2), dose/concentration 'guidance values' are provided in the GHS. The guidance values and ranges for single and repeated doses are intended only for guidance purposes. This means that they are to be used as part of the weight of evidence approach, and to assist with decisions about classification. They are not intended as strict demarcation values. The guidance value for repeated dose effects refer to effects seen in a standard 90-day toxicity study conducted in rats. They can be used as a basis to extrapolate equivalent guidance values for toxicity studies of greater or lesser duration.

3.2.10 Aspiration Hazard

Aspiration toxicity includes severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration. Aspiration is the entry of a liquid or solid directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system. Some hydrocarbons (petroleum distillates) and certain chlorinated hydrocarbons have been shown to pose an aspiration hazard in humans. Primary alcohols, and ketones have been shown to pose an aspiration hazard only in animal studies.

Table 3.16 Aspiration Toxicity

Category 1: Known (regarded) human	**Category 2:** Presumed human
- human evidence - hydrocarbons with kinematic viscosity ? 20.5 mm^2/s at 40° C.	- Based on animal studies - surface tension, water solubility, boiling point - kinematic viscosity ? 14 mm^2/s at 40°C & not Category 1

Substances and mixtures of this hazard class are assigned to one of two hazard categories this hazard class on the basis of viscosity.

3.3 Environmental Hazards

3.3.1 Hazardous to the Aquatic Environment

The harmonized criteria are considered suitable for packaged goods in both supply and use in multi-modal transport schemes. Elements of it may be used for bulk land transport and bulk marine transport under MARPOL (International Convention for the Prevention of Pollution from Ships) insofar as this uses aquatic toxicity. Two Guidance Documents (Annexes 8 and 9 of the GHS Document) cover issues such as data interpretation and the application of the criteria to special substances. Considering the complexity of this endpoint and the breadth of the application, the Guidance Annexes are important in the application of the harmonized criteria.

3.3.1.1 Acute Aquatic Toxicity

Acute aquatic toxicity means the intrinsic property of a material to cause injury to an aquatic organism in a short-term exposure. Substances and mixtures of this hazard class are assigned to one of three toxicity categories on the basis of acute toxicity data: LC_{50} (fish) or EC_{50} (crustacea) or ErC_{50} (for algae or other aquatic plants). In some regulatory systems these acute toxicity categories may be subdivided or extended for certain sectors.

3.3.1.2 Chronic Aquatic Toxicity

Chronic aquatic toxicity means the potential or actual properties of a material to cause adverse effects to aquatic organisms during exposures that are determined in relation to the lifecycle of the organism. Substances and mixtures in this hazard class are assigned to one of four toxicity categories on the basis of acute data *and* environmental fate data: LC_{50} (fish) or EC_{50} (crustacea) or ErC_{50} (for algae or other aquatic plants) *and* degradation/bioaccumulation.

While experimentally derived test data are preferred, where no experimental data are available, validated Quantitative Structure Activity Relationships (QSARs) for aquatic toxicity and log KOW may be used in the classification process. The log K_{OW} is a surrogate for a measured Bioconcentration Factor (BCF), where such a measured BCF value would always take precedence.

Chronic Category IV is considered a "safety net" classification for use when the available data do not allow classification under the formal criteria, but there are some grounds for concern.

Table 3.17 Acute & Chronic Aquatic Toxicity

Acute Cat. I Acute toxicity ≤ 1.00 mg/l	**Acute Cat. II** Acute toxicity > 1.00 but ≤ 10.0 mg/l	**Acute Cat. III** Acute toxicity ≤ 10.0 but < 100 mg/l	
Chronic Cat. I Acute toxicity ≤ 1.00 mg/l and lack of rapid degradability and log K_{ow} ≥ 4 unless BCF < 500	**Chronic Cat. II** Acute toxicity > 1.00 but ≤ 10.0 mg/l and lack of rapid degradability and log K_{ow} ≥ 4 unless BCF < 500 and unless chronic toxicity > 1 mg/l	**Chronic Cat. III** Acute toxicity > 10.0 but ≤ 100.0 mg/l and lack of rapid degradability and log K_{ow} ≥ 4 unless BCF < 500 and unless chronic toxicity > 1 mg/l	**Chronic Cat. IV** Acute toxicity > 100 mg/l and lack of rapid degradability and log K_{ow} ≥ 4 unless BCF < 500 and unless chronic toxicity > 1 mg/l

3.4 What is the GHS approach to classifying mixtures?
For consistency and understanding the provisions for classifying mixtures, the GHS defines certain terms. These working definitions are for the purpose of evaluating or determining the hazards of a product for classification and labeling.

***Substance*:** Chemical elements and their compounds in the natural state or obtained by any production process, including any *additive* necessary to preserve the stability of the product and any *impurities* deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Mixture: Mixtures or solutions composed of two or more substances in which they do not react.

Alloy: An alloy is a metallic material, homogeneous on a macroscopic scale, consisting of two or more elements so combined that they cannot be readily separated by mechanical means. Alloys are considered to be mixtures for the purpose of classification under the GHS.

Where impurities, additives or individual constituents of a substance or mixture have been identified and are themselves classified, they should be taken into account during classification if they exceed the cutoff value/concentration limit for a given hazard class.

Figure 3.4

Tier Approach to Classification of Mixtures

Generally, use test data for the mixture, if available,
↓
Compared to substance hazard criteria
Use bridging principles, if applicable
↓
Estimate hazard(s) based on the known component information

As mentioned previously, the GHS physical hazard criteria apply to mixtures. It is assumed that mixtures will be tested for physical hazards. Each health and environmental endpoint chapter in the GHS contains specific criteria for classifying mixtures as well as substances. The GHS Document or "Purple Book" should be consulted for complete information on classifying mixtures.

The process established for classifying a mixture allows the use of (a) available data for the mixture itself and/or (b) similar mixtures and/or (c) data for ingredients of the mixture. The GHS approach to the classification of mixtures for health and environmental hazards is tiered, and is dependent upon the amount of information available for the mixture itself and for its components. The process for the classification of mixtures is based on the following steps:

(1) Where test data are available for the mixture itself, the classification of the mixture will be based on that data (See exception for carcinogens, mutagens & reproductive toxins in the GHS Document); (2) Where test data are not available for the mixture itself, then the appropriate bridging principles (as described below) in the specific chapter should be used; (3) If (i) test data are not available for the mixture itself, and (ii) the bridging principles cannot be applied, then use the calculation or cutoff values described in the specific endpoint to classify the mixture.

3.5 What are bridging principles?

Bridging principles are an important concept in the GHS for classifying untested mixtures. When a mixture has not been tested, but there are sufficient data on the components and/or similar tested mixtures, these data can be used in accordance with the following bridging principles:

- **Dilution**: If a mixture is diluted with a diluent that has an equivalent or lower toxicity, then the hazards of the new mixture are assumed to be equivalent to the original.
- **Batching**: If a batch of a complex substance is produced under a controlled process, then the hazards of the new batch are assumed to be equivalent to the previous batches.
- **Concentration of Highly Toxic Mixtures**: If a mixture is severely hazardous, then a concentrated mixture is also assumed to be severely hazardous
- **Interpolation within One Toxic Category: Mixtures** having component concentrations within a range where the hazards are known are assumed to have those known hazards.
- **Substantially Similar Mixtures**: Slight changes in the concentrations of components are not expected to change the hazards of a mixture and substitutions involving toxicologically similar components are not expected to change the hazards of a mixture
- **Aerosols**: An aerosol form of a mixture is assumed to have the same hazards as the tested, non-aerosolized form of the mixture unless the propellant affects the hazards upon spraying.

All bridging principles do not apply to every health and environmental endpoint. Consult each endpoint to determine which bridging principles apply.

When the bridging principles do not apply or cannot be used, the health and environmental hazards of mixtures are estimated based on component information. In the GHS, the methodology used to estimate these hazards varies by endpoint. The GHS Document or "Purple Book" should be consulted for more complete information on classifying mixtures. Figure 3.5 summarizes the GHS mixtures approach for the various health and environmental endpoints.

3.6 What testing is required?

The GHS itself does not include requirements for testing substances or mixtures. Therefore, there is no requirement under the GHS to generate test data for any hazard class. Some parts of regulatory systems may require data to be generated (e.g., for pesticides), but these requirements are not related specifically to the GHS. The GHS criteria for determining health and environmental hazards are test method neutral, allowing different approaches as long as they are scientifically sound and validated according to international procedures and criteria already referred to in existing systems.

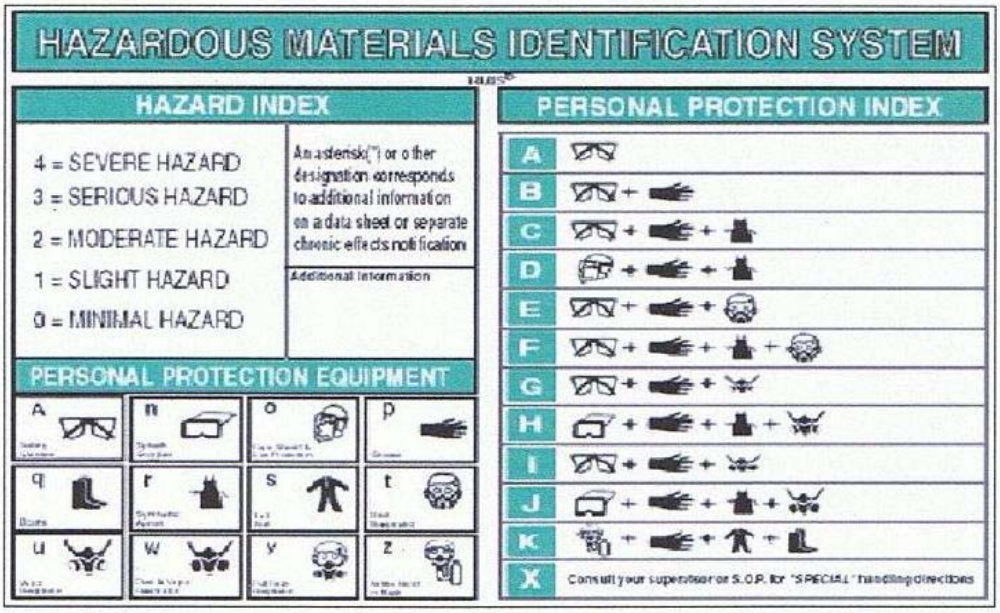
Test data already generated for the classification of chemicals under existing systems should be accepted when classifying these chemicals under the GHS, thereby avoiding duplicative testing and the unnecessary use of test animals. The GHS physical hazard criteria are linked to specific test methods. It is assumed that mixtures will be tested for physical hazards.

Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the material safety data sheets may be kept at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency

Figure 3.5 GHS Mixtures

Hazard Endpoint	Classification Approach	Bridging Principles Comments	
Acute toxicity	Acute Toxicity Estimate (ATE): 2 formulas	All	Conversion values, relevant components usually at ³ 1%
Serious Eye Damage & Eye Irritation	Mostly additivity approach, sometimes cutoffs	All	Relevant components usually at ³ 1%, exceptions for certain chemical classes
Skin corrosion & Skin Irritation	Mostly additivity approach, sometimes cutoffs	All	Relevant components usually at ³ 1%, exceptions for certain chemical classes
Skin Sensitization	Cutoffs with CA options	Dilution, Batching, Substantially similar mixtures, Aerosols	
Respiratory Sensitization	Cutoffs with CA options	Dilution, Batching, Substantially similar mixtures, Aerosols	
Germ Cell Mutagenicity	Cutoffs	Dilution, Batching, Substantially similar mixtures	Mixture test data only case-by case
Carcinogenicity	Cutoffs with CA options	Dilution, Batching, Substantially similar mixtures	Mixture test data only case-by-case
Reproductive Toxicity	Cutoffs with CA options	Dilution, Batching, Substantially similar mixtures	Mixture test data only case-by-case
Target Organ Systemic Toxicity	Cutoffs with CA options	All	
Aspiration Toxicity	Cutoffs	Dilution, Batching, Concentration of highly toxic mixtures, Interpolation within one toxicity category, Substantially similar mixtures	
Hazardous to the Aquatic Environment	Additivity Formula (Acute only); Summation Method (Acute or Chronic); Combination of Additivity Formula & Summation Method	Dilution, Batching, Concentration of highly toxic mixtures, Interpolation within one toxicity category, Substantially similar mixtures	Relevant components usually at ³ 1%, Mixture test data only case-by-case for chronic

HEALTH	
FLAMMABILITY	
REACTIVITY	
PERSONAL PROTECTION	



HAZARDOUS MATERIAL INFORMATION SYSTEM

4.0 Hazard Communication

Section 3, explained that classification is the starting point for the GHS. Once a chemical has been classified, the hazard(s) must be communicated to target audiences. As in existing systems, labels and Safety Data Sheets are the main tools for chemical hazard communication. They identify the hazardous properties of chemicals that may pose a health, physical or environmental hazard during normal handling or use. The goal of the GHS is to identify the intrinsic hazards found in chemical substances and mixtures, and to convey information about these hazards.

The international mandate for the GHS included the development of a harmonized hazard communication system, including labeling, Safety Data Sheets and easily understandable symbols, based on the classification criteria developed for the GHS.

4.1 What factors influenced development of the GHS communication tools?
Early in the process of developing the GHS communication tools, several significant issues were recognized. One of the most important was comprehensibility of the information provided. After all, the aim of the system is to present hazard information in a manner that the intended audience can easily understand and that will thus minimize the possibility of adverse effects resulting from exposure. The GHS identifies some guiding principles to assist in this process:

- Information should be conveyed in more than one way, e.g., text and symbols;
- The comprehensibility of the components of the system should take account of existing studies and literature as well as any evidence gained from testing;
- The phrases used to indicate degree (severity) of hazard should be consistent across the health, physical and environmental hazards.

Comprehensibility is challenging for a single culture and language. Global harmonization has numerous complexities. Some factors that affected the work include:

- Different philosophies in existing systems on how and what should be communicated;
- Language differences around the world;
- Ability to translate phrases meaningfully;
- Ability to understand and appropriately respond to symbols/pictograms.

These factors were considered in developing the GHS communication tools. The GHS Purple Book includes a comprehensibility-testing instrument in Annex 6.

4.2 Labels

4.2.1 What does a label look like?

Existing systems have labels that look different for the same product. We know that this leads to worker confusion, consumer uncertainty and the need for additional resources to maintain different systems. In the U.S. as well as in other countries, chemical products are regulated by sector/target audience. Different agencies regulate the workplace, consumers, agricultural chemicals and transport. Labels for these sectors/target audiences vary both in the U.S. and globally.

In order to understand the value of the GHS and its benefits to all stakeholders, it is instructive to look at the different labels for one fictional product. In the U.S. the product, ToxiFlam, which has a flash point of 120°F and has an oral LD50 of 275 mg/kg, has different labels for different sectors/target audiences. Label examples as seen in the U.S.A. are shown first, followed by international examples.

4.2.2 USA Examples:

Workplace and Workers

In the U.S., regulatory requirements for workplace labels are 'performance oriented'. This results at a minimum in a straightforward label that has a product identity, hazard statement and supplier identification (Figure 4.1). Some products can also have additional labeling requirements depending on their end use.

Figure 4.1
ToxiFlam
TOXIC
COMBUSTIBLE LIQUID AND
VAPOR

My Company, My Street, MyTown NJ
00000
Tel. 444 999 9999

However, many companies follow the voluntary ANSI Z129.1 Precautionary Labeling Standard for workplace labeling and often use it also for labeling consumer products. The American National Standards Institute (ANSI) standard includes several label elements that are core to the GHS as well as other helpful elements to assist users in safe handling (Figure 4.2).

Figure 4.2
ToxiFlam (Contains XYZ)

WARNING! HARMFUL IF SWALLOWED, FLAMMABLE LIQUID AND VAPOR

Do not taste or swallow. Do not take internally. Wash thoroughly after handling. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation.

FIRST AID: If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
In case of Fire, use water fog, dry chemical, CO_2, or alcohol foam. Water may be ineffective.

Flash Point = 120°F. Residue vapor may explode or ignite on ignition; do not cut, drill, grind, or weld on or near the container.

See Material Safety Data Sheet for further details regarding safe use of this product.

My Company, My Street, MyTown NJ 00000 Tel. 444 999 9999

Consumer Products and Consumers

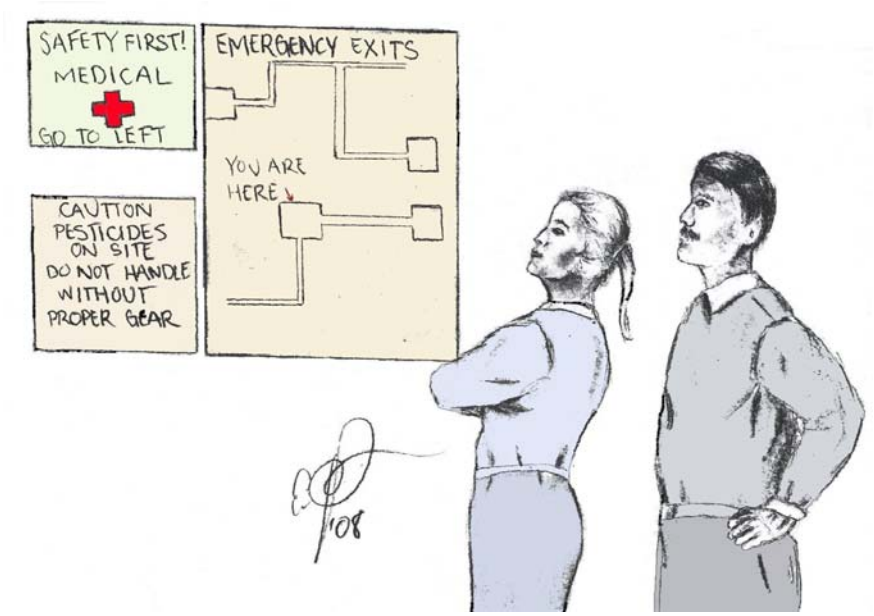
Figure 4.3
ToxiFlam
(Contains XYZ)

WARNING! HARMFUL IF SWALLOWED, FLAMMABLE LIQUID AND VAPOR
Do not taste or swallow. Do not take internally. Wash thoroughly after handling. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation.

FIRST AID
If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Keep out of reach of children

My Company, My Street, MyTown NJ 00000 Tel. 444 999 9999

In several countries consumer products are regulated separately from workplace chemicals. In the U.S. the CPSC regulates consumer products. Consumer products have required label elements, but only the signal words are specified. The ANSI labeling standard is often used in developing consumer labels.

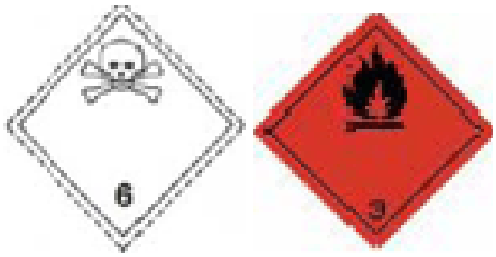


GLOBALLY HARMONIZED SYSTEM CLASSIFCATION LABELS

Transport and Emergency Responders

For hazardous products being transported, outer containers have required label elements, product identifier and hazard symbols. Transportation requirements are in addition to workplace or end use label requirements.

Figure 4.4
Flammable liquids, toxic, n.o.s. (contains XYZ)
UN 1992



My Company, My Street NJ 00000

Agricultural Chemicals and Pesticides
In many systems, agricultural chemicals often have special label requirements. In the U.S. the EPA is the agency covering these chemicals. A pesticide product with the same hazards as ToxiFlam would have a label developed using FIFRA requirements. FIFRA has requirements for product identity, chemical identity, signal word, hazard statements, and precautionary measures including first aid.

Figure 4.5
ToxiFlam
Active/ Inerts: Contains XYZ %

KEEP OUT OF THE REACH OF CHILDREN
PRECAUTIONARY STATEMENTS - HAZARDS TO HUMANS AND DOMESTIC ANIMALS:
WARNING: May be fatal if swallowed. Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco .
PHYSICAL AND CHEMICAL HAZARDS: Combustible. Do not use or store near heat or open flame.

FIRST AID:
If swallowed
- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

My Company, My Street, My Town AZ 00000, Tel: 444 999 9999

EPA Est . No. 5840-AZ-1 EPA Reg. No. 3120-280

4.2.3 International Examples

All the previous examples are specific to the U.S. Many companies do business globally. So in addition to the U.S. regulations, these companies would need to comply with the corresponding regulations in the countries to which they export products. Canada and the EU are two existing systems that were considered in the development of the GHS. To illustrate the differences in labeling, it is interesting to examine an EU and Canadian label for ToxiFlam.

European Union Label

Labels in the EU have chemical identity, symbols, and R/S (Risk and Safety) phrases which are hazard statements, precautionary measures and first aid.

Figure 4.6
ToxiFlam (contains XYZ)

KEEP OUT OF THE REACH OF CHILDREN

Harmful If Swallowed. (R22)
Flammable. (R10)
Keep away from food, drink and animal feeding stuffs. (S13)
Wear suitable protective clothing. (S36)
If swallowed, seek medical advice immediately and show this Container label. (S46)
In case of fire, use water, fog, CO_2, or alcohol foam. (S43)

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Canadian Workplace Hazardous Materials Identification System (WHMIS) Label

The WHMIS label requires product identifier, hazard symbol, hazard statement, precautionary measures, first aid, MSDS statement and supplier identification. In addition to these common label elements, WHMIS requires a hatched border.

Figure 4.7
ToxiFlam

TOXIC
COMBUSTIBLE LIQUID AND VAPOR

Do not taste or swallow. Do not take internally. Wash thoroughly after handling. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation.

FIRST AID

If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

See Material Safety Data Sheet for further details regarding safe use of this product.

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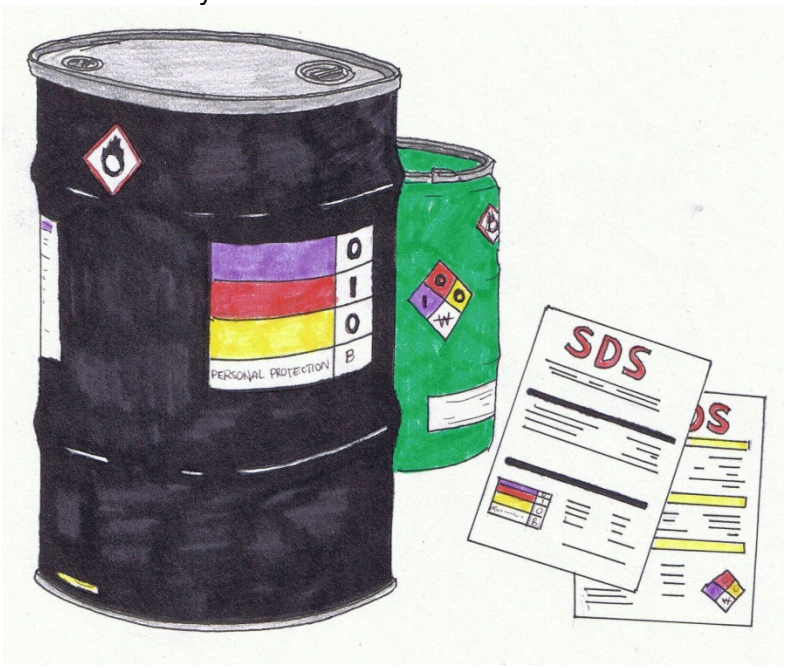
4.3 What are the GHS label elements?

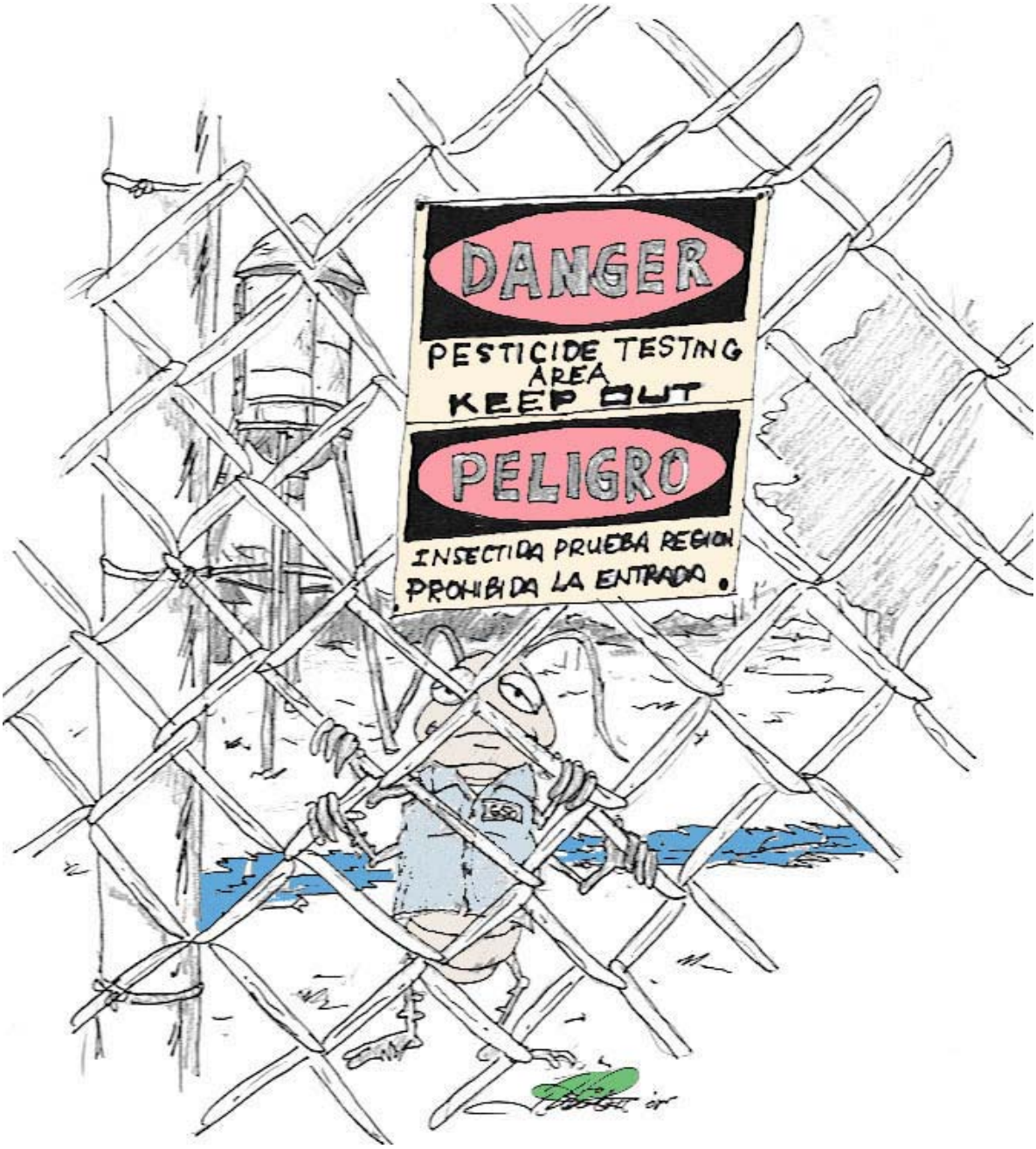
Some GHS label elements have been standardized (identical with no variation) and are directly related to the endpoints and hazard level. Other label elements are harmonized with common definitions and/or principles. See Figure 4.8 for an illustration of the GHS label elements.

The standardized label elements included in the GHS are:

- **Symbols (hazard pictograms)**: Convey health, physical and environmental hazard information, assigned to a GHS hazard class and category.
- **Signal Words:** "Danger" or "Warning" are used to emphasize hazards and indicate the relative level of severity of the hazard, assigned to a GHS hazard class and category.
- **Hazard Statements:** Standard phrases assigned to a hazard class and category that describe the nature of the hazard.

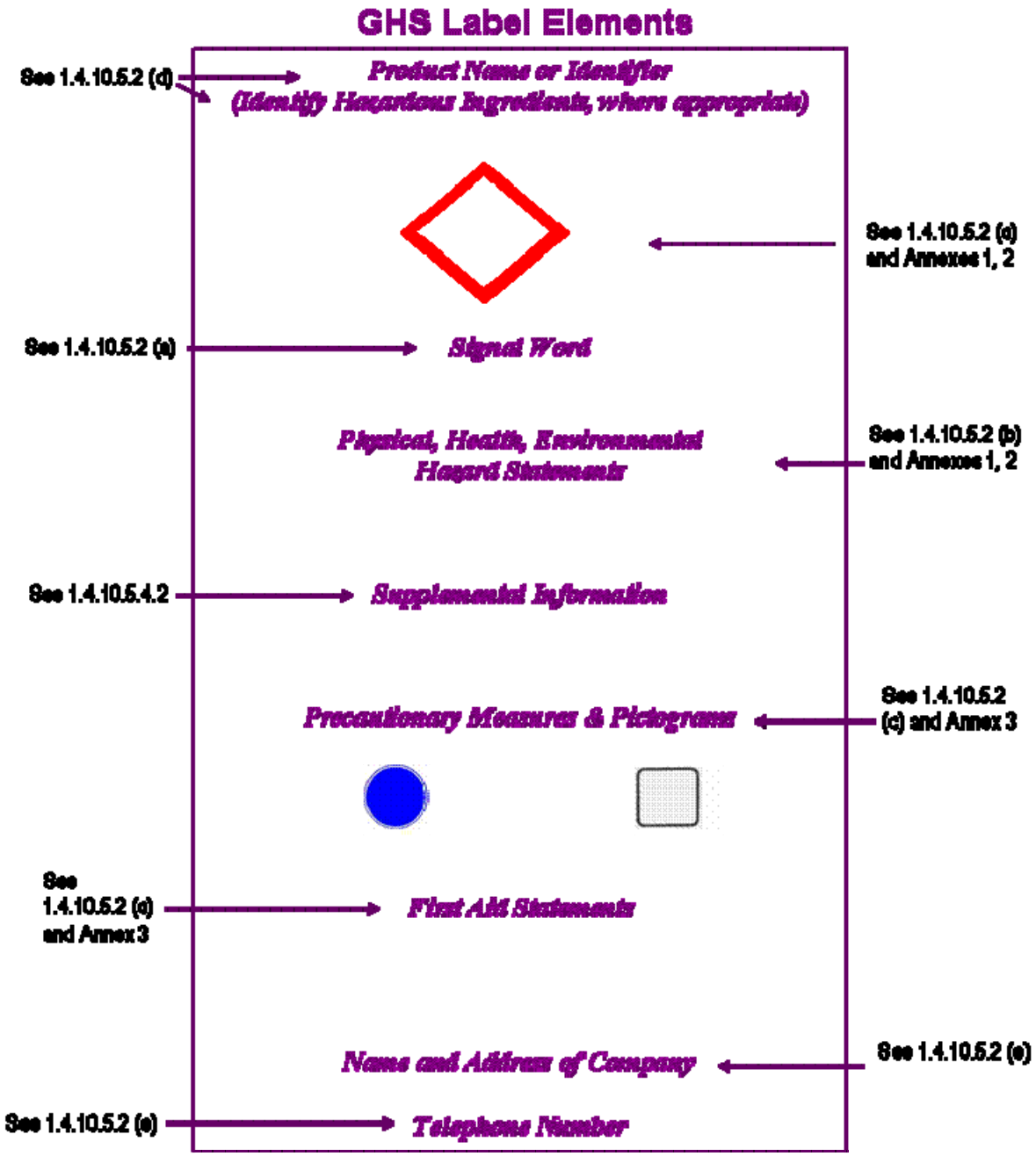
The symbols, signal words, and hazard statements have all been standardized and assigned to specific hazard categories and classes, as appropriate. This approach makes it easier for countries to implement the system and should make it easier for companies to comply with regulations based on the GHS. The prescribed symbols, signal words, and hazard statements can be readily selected from Annex 1 of the GHS Purple Book. These standardized elements are not subject to variation, and should appear on the GHS label as indicated in the GHS for each hazard category/class in the system. The use of symbols, signal words or hazard statements other than those that have been assigned to each of the GHS hazards would be contrary to harmonization.





Reproductive toxin: Any agent that has a harmful effect on the adult male or female reproductive system or a developing fetus or child. Such hazards have a variety of effects on people, including loss of sexual drive, mental disorders, impotence, infertility, sterility, mutagenic effects on germ cells, teratogenic effects on a fetus, and transplacental carcinogenesis.

Figure 4.8



The Section numbers refer to the sections in the GHS Document or "Purple Book".

4.3.1 Symbols/Pictograms

The GHS symbols have been incorporated into pictograms for use on the GHS label. Pictograms include the harmonized hazard symbols plus other graphic elements, such as borders, background patterns or colors which are intended to convey specific information. For transport, pictograms (Table 4.10) will have the background, symbol and colors currently used in the UN Recommendations on the Transport of Dangerous Goods, Model Regulations.

For other sectors, pictograms (Table 4.9) will have a black symbol on a white background with a red diamond frame. A black frame may be used for shipments within one country. Where a transport pictogram appears, the GHS pictogram for the same hazard should not appear.

4.3.2 Signal Words

The signal word indicates the relative degree of severity a hazard. The signal words used in the GHS are

"Danger" for the more severe hazards, and
"Warning" for the less severe hazards.

Signal words are standardized and assigned to the hazard categories within endpoints. Some lower level hazard categories do not use signal words. Only one signal word corresponding to the class of the most severe hazard should be used on a label.

4.3.3 Hazard Statements

Hazard statements are standardized and assigned phrases that describe the hazard(s) as determined by hazard classification. An appropriate statement for each GHS hazard should be included on the label for products possessing more than one hazard. The assigned label elements are provided in each hazard chapter of the Purple Book as well as in Annexes 1 & 2. Figure 4-11 illustrates the assignment of standardized GHS label elements for the acute oral toxicity categories.

Figure 4.9

GHS Pictograms and Hazard Classes		
		
▪ Oxidizers	▪ Flammables ▪ Self Reactives ▪ Pyrophorics ▪ Self-Heating ▪ Emits Flammable Gas ▪ Organic Peroxides	▪ Explosives ▪ Self Reactives ▪ Organic Peroxides
		
▪ Acute toxicity (severe)	▪ Corrosives	▪ Gases Under Pressure
		
▪ Carcinogen ▪ Respiratory Sensitizer ▪ Reproductive Toxicity	▪ Environmental Toxicity	▪ Irritant ▪ Dermal Sensitizer ▪ Acute toxicity (harmful)

▪ Target Organ Toxicity ▪ Mutagenicity ▪ Aspiration Toxicity		▪ Narcotic Effects ▪ Respiratory Tract ▪ Irritation

This photograph shows a delivery of Sulfuric Acid. The delivery driver is wearing only work gloves. He is clearly in violation of the proper PPE. The Hazard Communication Standard requires employees to understand chemical hazards, labels, and SDSs and to use them on the job. Before starting jobs involving possible exposure to hazardous substances, employees must read SDSs to know what they're working with and procedures for safe handling.

Figure 4.10

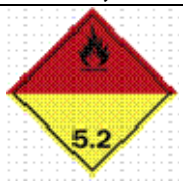
Transport "Pictograms"		
		
Flammable Liquid Flammable Gas Flammable Aerosol	Flammable solid Self-Reactive Substances	Pyrophorics (Spontaneously Combustible) Self-Heating Substances
		
Substances, which in contact with water, emit flammable gases (Dangerous When Wet)	Oxidizing Gases Oxidizing Liquids Oxidizing Solids	Explosive Divisions 1.1, 1.2, 1.3
		
Explosive Division 1.4	Explosive Division 1.5	Explosive Division 1.6
		
Compressed Gases	Acute Toxicity (Poison): Oral, Dermal, Inhalation	Corrosive
		
Marine Pollutant	Organic Peroxides	

Figure 4.11

ACUTE ORAL TOXICITY - Annex 1					
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**
LD_{50}	less 5 mg/kg	> 5 < 50 mg/kg	³ 50 < 300 mg/kg	³ 300 < 2000 mg/kg	³ 2000 < 5000 mg/kg
Pictogram					No symbol
Signal word	Danger	Danger	Danger	Warning	Warning
Hazard statement	Fatal if swallowed	Fatal if swallowed	Toxic if swallowed	Harmful if swallowed	May be harmful if swallowed

Other GHS label elements include:

- **Precautionary Statements and Pictograms:** Measures to minimize or prevent adverse effects.
- **Product Identifier (ingredient disclosure):** Name or number used for a hazardous product on a label or in the SDS.
- **Supplier identification:** The name, address and telephone number should be provided on the label.
- **Supplemental information:** non-harmonized information.

4.3.4 Precautionary Statements and Pictograms

Precautionary information supplements the hazard information by briefly providing measures to be taken to minimize or prevent adverse effects from physical, health or environmental hazards. First aid is included in precautionary information. The GHS label should include appropriate precautionary information. Annex 3 of the GHS Purple Book includes precautionary statements and pictograms that can be used on labels.

Annex 3 includes four types of precautionary statements covering: prevention, response in cases of accidental spillage or exposure, storage, and disposal**.** The precautionary statements have been linked to each GHS hazard statement and type of hazard. The goal is to promote consistent use of precautionary statements. Annex 3 is guidance and is expected to be further refined and developed over time.

4.3.5 Product Identifier (Ingredient Disclosure)

A product identifier should be used on a GHS label and it should match the product identifier used on the SDS. Where a substance or mixture is covered by the UN Model Regulations on the Transport of Dangerous Goods, the UN proper shipping name should also be used on the package.

The GHS label for a substance should include the chemical identity of the substance (name as determined by IUPAC, ISO, CAS or technical name). For mixtures/alloys, the label should include the chemical identities of all ingredients that contribute to acute toxicity, skin corrosion or serious eye damage, germ cell mutagenicity, carcinogenicity, reproductive

toxicity, skin or respiratory sensitization, or Target Organ Systemic Toxicity (TOST), when these hazards appear on the label. Where a product is supplied exclusively for workplace use, the Competent Authority may give suppliers discretion to include chemical identities on the SDS, in lieu of including them on labels. The Competent Authority rules for confidential business information (CBI) take priority over the rules for product identification.

4.3.6 Supplier Identification
The name, address and telephone number of the manufacturer or supplier of the product should be provided on the label.

4.3.7 Supplemental Information
Supplemental label information is non-harmonized information on the container of a hazardous product that is not required or specified under the GHS. In some cases this information may be required by a Competent Authority or it may be additional information provided at the discretion of the manufacturer/distributor. The GHS provides guidance to ensure that supplemental information does not lead to wide variation in information or undermine the GHS information. Supplemental information may be used to provide further detail that does not contradict or cast doubt on the validity of the standardized hazard information. It also may be used to provide information about hazards not yet incorporated into the GHS. The labeler should have the option of providing supplementary information related to the hazard, such as physical state or route of exposure, with the hazard statement.

4.4 How are multiple hazards handled on labels?
Where a substance or mixture presents more than one GHS hazard, there is a GHS precedence scheme for pictograms and signal words. For substances and mixtures covered by the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, the precedence of symbols for physical hazards should follow the rules of the UN Model Regulations. For health hazards the following principles of precedence apply for symbols:

(a) if the skull and crossbones applies, the exclamation mark should not appear;
(b) if the corrosive symbol applies, the exclamation mark should not appear where it is used for skin or eye irritation;
(c) if the health hazard symbol appears for respiratory sensitization, the exclamation mark should not appear where it is used for skin sensitization or for skin or eye irritation.

If the signal word 'Danger' applies, the signal word 'Warning' should not appear. All assigned hazard statements should appear on the label. The Competent Authority may choose to specify the order in which they appear.

4.5 Is there a specific GHS label format / layout?
The GHS hazard pictograms, signal word and hazard statements should be located together on the label. The actual label format or layout is not specified in the GHS. National authorities may choose to specify where information should appear on the label or allow supplier discretion.

Figure 4.12 shows an example of a GHS label for the fictional product 'ToxiFlam'. The core GHS label elements are expected to replace the need for the array of different labels shown earlier for ToxiFlam. (Figure 4.8 also illustrates the GHS label elements.)

Figure 4.12 Example GHS Inner Container Label (e.g., bottle inside a shipping box)

ToxiFlam (Contains: XYZ)

Danger! Toxic If Swallowed, Flammable Liquid and Vapor

Do not eat, drink or use tobacco when using this product. Wash hands thoroughly after handling. Keep container tightly closed. Keep away from heat/sparks/open flame. - No smoking. Wear protective gloves and eye/face protection. Ground container and receiving equipment. Use explosion-proof electrical equipment. Take precautionary measures against static discharge.

Use only non-sparking tools. Store in cool/well-ventilated place.

IF SWALLOWED: Immediately call a POISON CONTROL CENTER or doctor/physician. Rinse mouth.

In case of fire, use water fog, dry chemical, CO_2, or "alcohol" foam.

See Material Safety Data Sheet for further details regarding safe use of this product.

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There has been discussion about the size of GHS pictograms and that a GHS pictogram might be confused with a transport pictogram or "diamond". Transport pictograms (Table 4.10) are different in appearance than the GHS pictograms (Table 4.9). Annex 7 of the Purple Book explains how the GHS pictograms are expected to be proportional to the size of the label text. So that generally the GHS pictograms would be smaller than the transport pictograms.

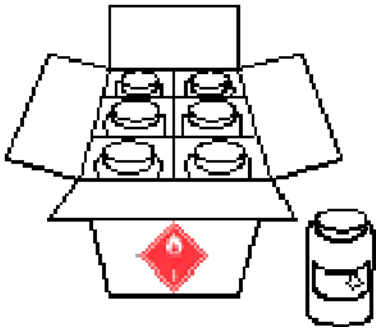

Figure 4.13 Combination Packaging (Outer box with inner bottles)

Several arrangements for GHS labels are also provided in Annex 7 of the Purple Book. Figure 4.13 shows an arrangement for a combination packaging with an outer shipping box and inner bottles. The shipping box has a transportation pictogram. The inner bottles have a GHS label with a GHS pictogram.

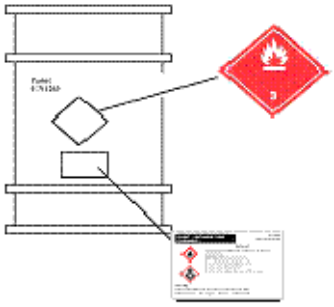

Figure 4.14 Combination Packaging (Outer box with inner bottles)

For a container such as a 55 gallon drum, the transport required markings and pictograms may be combined with the GHS label elements or presented separately. In Figure 4.14 a label arrangement for a single packaging such as a 55 gallon drum is shown. Pictograms and markings required by the transport regulations as well as GHS label and non-duplicative GHS pictogram are shown on the drum.

A label merging the transportation requirements and the GHS requirements into one label for the fictional product "ToxiFlam" is shown in Figure 4.15. This combined type label could also be used on a 55 gallon drum.

Figure 4.15 Example GHS Outer Container Label (55 gallon/200 liter drum)

ToxiFlam

Danger! Toxic If Swallowed
Flammable Liquid and Vapor

Flammable liquids, toxic, n.o.s.
(contains XYZ)
UN 1992

Do not eat, drink or use tobacco when using this product. Wash hands thoroughly after handling. Keep container tightly closed. Keep away from heat/sparks/open flame. - No smoking. Wear protective gloves and eye/face protection. Ground container and receiving equipment. Use explosion-proof electrical equipment. Take precautionary measures against static discharge. Use only non-sparking tools. Store in cool/well-ventilated place

IF SWALLOWED: Immediately call a POISON CONTROL CENTER or doctor/physician. Rinse mouth.

In case of fire, use water fog, dry chemical, CO_2, or "alcohol" foam.

See Material Safety Data Sheet for further details regarding safe use of this product.

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4.6 What about risk?
Competent Authorities may vary the application of the components of the GHS by the type of product (industrial, pesticide, consumer, etc.) or the stage in the lifecycle (workplace, farm, retail store, etc.). Once a chemical is classified, the likelihood of adverse effects may be considered in deciding what informational or other steps should be taken for a given product or use setting. Annex 5 of the GHS Purple Book includes a discussion of an example of how risk-based labeling could be considered for chronic health effects of consumer products in the consumer use setting.

4.7 Are workplace containers covered in the GHS ?
Products falling within the scope of the GHS will carry the GHS label at the point where they are supplied to the workplace, and that label should be maintained on the supplied container in the workplace. The GHS label or label elements can also be used for workplace containers (e.g., storage tanks). However, the Competent Authority can allow employers to use alternative means of giving workers the same information in a different written or displayed format when such a format is more appropriate to the workplace and communicates the information as effectively as the GHS label. For example, label information could be displayed in the work area, rather than on the individual containers. Some examples of workplace situations where chemicals may be transferred from supplier containers include: containers for laboratory testing, storage vessels, piping or process reaction systems or temporary containers where the chemical will be used by one worker within a short timeframe.

4.8 What is the GHS Safety Data Sheet (SDS)?
The (Material) Safety Data Sheet (SDS) provides comprehensive information for use in workplace chemical management. Employers and workers use the SDS as sources of information about hazards and to obtain advice on safety precautions. The SDS is product related and, usually, is not able to provide information that is specific for any given workplace where the product may be used. However, the SDS information enables the employer to develop an active program of worker protection measures, including training, which is specific to the individual workplace and to consider any measures that may be necessary to protect the environment. Information in a SDS also provides a source of information for other target audiences such as those involved with the transport of dangerous goods, emergency responders, poison centers, those involved with the professional use of pesticides and consumers.

The SDS should contain 16 headings (Figure 4.14). The GHS MSDS headings, sequence and content are similar to the ISO, EU and ANSI MSDS/SDS requirements, except that the order of sections 2 and 3 have been reversed. The SDS should provide a clear description of the data used to identify the hazards. Figure 4.14 and the GHS Purple Book provide the minimum information that is required in each section of the SDS. Examples of draft GHS SDSs are provided in Appendix B of this guidance document.

The revised Purple Book contains guidance on developing a GHS SDS (Annex 4). Other resources for SDSs include:

- ILO Standard under the Recommendation 177 on Safety in the Use of Chemicals at Work,

- International Standard 11014-1 (1994) of the International Standard Organization (ISO) and ISO Safety Data Sheet for Chemical Products 11014-1: 2003 DRAFT,

Figure 4.14

Minimum information for an SDS

1.	**Identification of the substance or mixture and of the supplier**	▪ GHS product identifier. ▪ Other means of identification. ▪ Recommended use of the chemical and restrictions on use. ▪ Supplier's details (including name, address, phone number, etc.). ▪ Emergency phone number.
2.	**Hazards identification**	▪ GHS classification of the substance/mixture and any national or regional information. ▪ GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) ▪ Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.
3.	**Composition/information on ingredients**	**Substance** ▪ Chemical identity. ▪ Common name, synonyms, etc. ▪ CAS number, EC number, etc. ▪ Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. **Mixture** ▪ The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cutoff levels. ***NOTE**: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification.*
4.	**First aid measures**	▪ Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion. ▪ Most important symptoms/effects, acute and delayed. ▪ Indication of immediate medical attention and special treatment needed, if necessary.
5.	**Firefighting measures**	▪ Suitable (and unsuitable) extinguishing media. ▪ Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). ▪ Special protective equipment and precautions for firefighters.
6.	**Accidental release measures**	▪ Personal precautions, protective equipment and emergency procedures.

		▪ Environmental precautions. ▪ Methods and materials for containment and cleaning up.
7.	**Handling and storage**	▪ Precautions for safe handling. ▪ Conditions for safe storage, including any incompatibilities.
8.	**Exposure controls/personal protection**.	▪ Control parameters, e.g., occupational exposure limit values or biological limit values. ▪ Appropriate engineering controls. ▪ Individual protection measures, such as personal protective equipment.
9.	**Physical and chemical properties**	▪ Appearance (physical state, color, etc.). ▪ Odor. ▪ Odor threshold. ▪ pH. ▪ melting point/freezing point. ▪ initial boiling point and boiling range. ▪ flash point. ▪ evaporation rate. ▪ flammability (solid, gas). ▪ upper/lower flammability or explosive limits. ▪ vapor pressure. ▪ vapor density. ▪ relative density. ▪ solubility(ies). ▪ partition coefficient: n-octanol/water. ▪ autoignition temperature. ▪ decomposition temperature.
10.	**Stability and reactivity**	▪ Chemical stability. ▪ Possibility of hazardous reactions. ▪ Conditions to avoid (e.g., static discharge, shock or vibration). ▪ Incompatible materials.

		▪ Hazardous decomposition products.
11.	**Toxicological information**	Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: ▪ information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); ▪ Symptoms related to the physical, chemical and toxicological characteristics; ▪ Delayed and immediate effects and also chronic effects from short- and long-term exposure; ▪ Numerical measures of toxicity (such as acute toxicity estimates).
12.	**Ecological information**	▪ Ecotoxicity (aquatic and terrestrial, where available). ▪ Persistence and degradability. ▪ Bioaccumulative potential. ▪ Mobility in soil. ▪ Other adverse effects.
13.	**Disposal considerations**	▪ Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.
14.	**Transport information**	▪ UN Number. ▪ UN Proper shipping name. ▪ Transport Hazard class(es). ▪ Packing group, if applicable. ▪ Marine pollutant (Yes/No). ▪ Special precautions which a user needs to be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.
15.	**Regulatory information**	▪ Safety, health and environmental regulations specific for the product in question.
16.	**Other information including information on preparation and revision of the SDS**	

4.9 What is the difference between the GHS SDS and existing MSDSs/SDSs?

SDSs are in use globally. So it is useful to have an understanding of the similarities and differences in the existing MSDS/SDS content and format and the GHS SDS content and format. A table comparing MSDS/SDS content/format is provided in Appendix A of this guidance document.

4.10 When should SDSs and labels be updated?

All hazard communication systems should specify a means of responding in an appropriate and timely manner to new information and updating labels and SDS information accordingly. Updating should be carried out promptly on receipt of the information that necessitates the revision. The Competent Authority may choose to specify a time limit within which the information should be revised.

Suppliers should respond to "new and significant" information they receive about a chemical hazard by updating the label and safety data sheet for that chemical. New and significant information is any information that changes the GHS classification and leads to a change in the label information or information that may affect the SDS.

4.11 How does the GHS address Confidential Business Information (CBI)?

Confidential business information (CBI) will not be harmonized under the GHS. National authorities should establish appropriate mechanisms for CBI protection. The GHS established CBI principles which include:

- CBI provisions should not compromise the health and safety of users;
- CBI claims should be limited to the names of chemicals and their concentrations in mixtures;
- Mechanisms should be established for disclosure in emergency and non-emergency situations.

4.12 Does the GHS address training?

The GHS states in Chapter 1.4, Section1.4.9, the importance of training all target audiences to recognize and interpret label and/or SDS information, and to take appropriate action in response to chemical hazards. Training requirements should be appropriate for and commensurate with the nature of the work or exposure. Key target audiences include workers, emergency responders and also those responsible for developing labels and SDSs. To varying degrees, the training needs of additional target audiences have to be addressed. These should include training for persons involved in transport and strategies required for educating consumers in interpreting label information on products that they use.

How will labels change under the revised Hazard Communication Standard?

Under the current Hazard Communication Standard (HCS), the label preparer must provide the identity of the chemical, and the appropriate hazard warnings. This may be done in a variety of ways, and the method to convey the information is left to the preparer. Under the revised HCS, once the hazard classification is completed, the standard specifies what information is to be provided for each hazard class and category.

Labels will require the following elements:

- **Pictogram:** a symbol plus other graphic elements, such as a border, background pattern, or color that is intended to convey specific information about the hazards of a chemical. Each pictogram consists of a different symbol on a white background within a red square frame set on a point (i.e. a red diamond). There are nine pictograms under the GHS. However, only eight pictograms are required under the HCS.

- **Signal words:** a single word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for less severe hazards.

- **Hazard Statement:** a statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

- **Precautionary Statement:** a phrase that describes recommended measures to be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical, or improper storage or handling of a hazardous chemical.

What pictograms are required in the revised Hazard Communication Standard? What hazard does each identify?

There are nine pictograms under the GHS to convey the health, physical and environmental hazards. The final Hazard Communication Standard (HCS) requires eight of these pictograms, the exception being the environmental pictogram, as environmental hazards are not within OSHA's jurisdiction.

HCS Pictograms and Hazards

Health Hazard	Flame	Exclamation Mark
		
• Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	• Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	• Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non Mandatory)
Gas Cylinder	**Corrosion**	**Exploding Bomb**
		
• Gases under Pressure	• Skin Corrosion/ burns • Eye Damage • Corrosive to Metals	• Explosives • Self-Reactives • Organic Peroxides
Flame over Circle	**Environment (Non Mandatory)**	**Skull and Crossbones**
		
• Oxidizers	• Aquatic Toxicity	• Acute Toxicity (fatal or toxic)

Can I use a black border on pictograms for domestic shipment?
Under the revised Hazard Communication Standard (HCS), pictograms must have red borders. OSHA believes that the use of the red frame will increase recognition and comprehensibility. Therefore, the red frame is required regardless of whether the shipment is domestic or international.

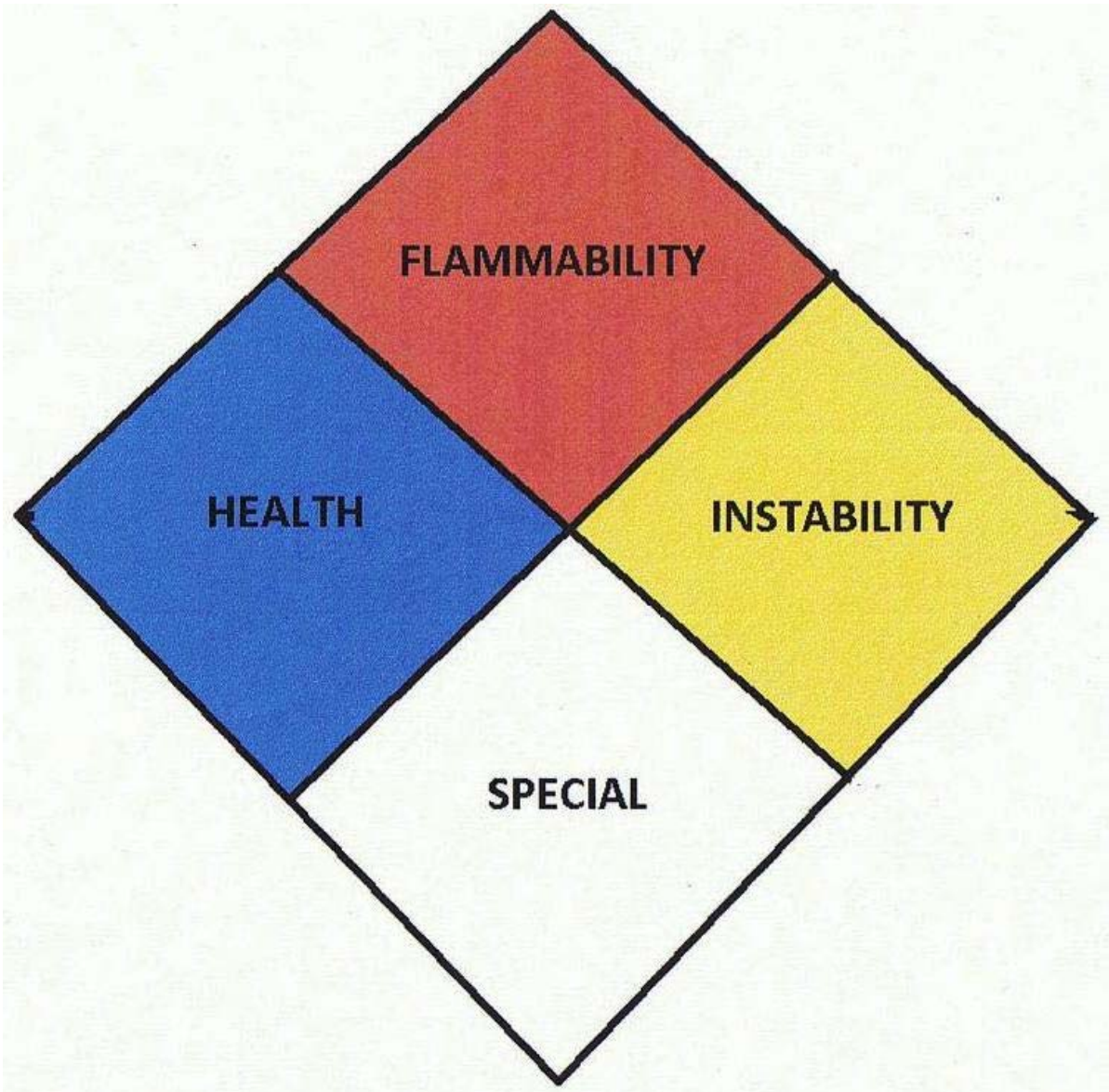
Will OSHA allow blank red borders?
The revised Hazard Communication Standard (HCS) requires that all red borders printed on the label have a symbol printed inside it. If OSHA were to allow blank red borders, workers may be confused about what they mean and concerned that some information is missing. OSHA has determined that prohibiting the use of blank red borders on labels is necessary to provide the maximum recognition and impact of warning labels and to ensure that users do not get desensitized to the warnings placed on labels.

When must label information be updated?
In the revised Hazard Communication Standard (HCS), OSHA is lifting the stay on enforcement regarding the provision to update labels when new information on hazards becomes available. Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within **six months** of becoming aware of the new information, and shall ensure that labels on containers of hazardous chemicals shipped after that time contain the new information. If the chemical is not currently produced or imported, the chemical manufacturer, importer, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

How will workplace labeling provisions be changing under the revised Hazard Communication Standard?
The current standard provides employers with flexibility regarding the type of system to be used in their workplaces and OSHA has retained that flexibility in the revised Hazard Communication Standard (HCS). Employers may choose to label workplace containers either with the same label that would be on shipped containers for the chemical under the revised rule, or with label alternatives that meet the requirements for the standard. Alternative labeling systems such as the National Fire Protection Association (NFPA) 704 Hazard Rating and the Hazardous Material Information System (HMIS) are permitted for workplace containers. However, the information supplied on these labels must be consistent with the revised HCS, e.g., no conflicting hazard warnings or pictograms.

How is the Safety Data Sheet (SDS) changing under the revised Hazard Communication Standard?
The information required on the safety data sheet (SDS) will remain essentially the same as that in the current standard. The current Hazard Communication Standard (HCS) indicates what information has to be included on an SDS but does not specify a format for presentation or order of information. The revised HCS requires that the information on the SDS is presented using consistent headings in a specified sequence.

Paragraph (g) of the final rule indicates the headings of information to be included on the SDS and the order in which they are to be provided. In addition, Appendix D indicates what information is to be included under each heading. The SDS format is the same as the ANSI standard format which is widely used in the U.S. and is already familiar to many employees.



NFPA FIRE DIAMOND

The format of the 16-section SDS should include the following sections:

Section 1. Identification
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
Section 13. Disposal considerations
Section 14. Transport information
Section 15. Regulatory information
Section 16. Other information, including date of preparation or last revision
Sections 12-15 may be included in the SDS, but are not required by OSHA.

Will TLVs be required on the Safety Data Sheet (SDS)?
OSHA is retaining the requirement to include the American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) on the safety data sheet (SDS) in the revised Standard. OSHA finds that requiring TLVs on the SDS will provide employers and employees with useful information to help them assess the hazards presented by their workplaces. In addition to TLVs, OSHA permissible exposure limits (PELs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet are also required.

May the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) lists be used to make carcinogen classifications?
In the revised Hazard Communication Standard (HCS), OSHA has provided classifiers with the option of relying on the classification listings of IARC and NTP to make classification decisions regarding carcinogenicity, rather than applying the criteria themselves. OSHA believes that this will make classification easier for classifiers, as well as lead to greater consistency. In addition, OSHA has provided in non-mandatory Appendix F of the revised rule, guidance on hazard classification for carcinogenicity. Part A of Appendix F includes background guidance provided by GHS based on the Preamble of the IARC "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006). Part B provides IARC classification information. Part C provides background guidance from the National NTP "Report on Carcinogens" (RoC), and Part D is a table that compares GHS carcinogen hazard categories to carcinogen classifications under IARC and NTP, allowing classifiers to be able to use information from IARC and NTP RoC carcinogen classifications to complete their classifications under the GHS, and thus the HCS.

Will the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) classifications be required on the Safety Data Sheet (SDS)?

OSHA has retained the requirement to include IARC and NTP classifications on safety data sheets (SDSs). Therefore, if a chemical is listed as a carcinogen by either IARC or NTP, it must be noted on the SDS. Additionally, if OSHA finds a chemical to be a carcinogen, it must be noted on the SDS as well.

How has OSHA addressed hazards covered under the current Hazard Communication Standard that have not been addressed by the GHS?

In the Notice of Proposed Rulemaking (NPRM), OSHA proposed to include hazards currently covered under the Hazard Communication Standard (HCS) that have yet to be addressed by the GHS (OSHA provided several examples: simple asphyxiants, and combustible dust) in a separate category called "Unclassified Hazards". In response to comments from the regulated community, OSHA has renamed the category to "Hazards Not Otherwise Classified (HNOC)" to minimize confusion. In the final HCS, HNOC hazards will not be required to be disclosed on the label but will be required to be disclosed in section 2 of the Safety Data Sheet (SDS). This reflects how GHS recommends these hazards should be disclosed. Chemical manufacturers and importers are expected to assess these hazards when they are conducting their hazard evaluation of physical and health hazards. A new or separate evaluation is not required. Also in the final standard, in response to comments, OSHA has removed pyrophoric gases, simple asphyxiants, and combustible dust from the HNOC hazard category and has addressed these chemicals individually (see question below for more information on each hazard).

How has OSHA addressed pyrophoric gases, simple asphyxiants, and combustible dust?

In the revised Hazard Communication Standard (HCS), OSHA has added pyrophoric gases, simple asphyxiants and combustible dust to the definition of "hazardous chemical". OSHA has also added definitions to the revised HCS for pyrophoric gases and simple asphyxiants, and provided guidance on how to define combustible dust for the purposes of complying with the HCS.

- **Pyrophoric gases**:
  OSHA has retained the definition for pyrophoric gases from the current HCS. Pyrophoric gases must be addressed both on container labels and SDSs. OSHA has provided label elements for pyrophoric gases which include the signal word "danger" and the hazard statement "catches fire spontaneously if exposed to air".

- **Simple asphyxiants:**
  OSHA has revised the definition of simple asphyxiants that was proposed in the Notice of Proposed Rulemaking (NPRM) as a result of comments from the regulated community. In the final HCS, simple asphyxiants must be labeled where appropriate, and be addressed on SDSs. OSHA has provided label elements for simple asphyxiants which include the signal word "warning" and the hazard statement "may displace oxygen and cause rapid suffocation".

- **Combustible dust:**
  OSHA has **not** provided a definition for combustible dust to the final HCS given ongoing activities in the specific rulemaking, as well as in the United Nations Sub-

Committee of Experts on the GHS (UN/SCEGHS). However, guidance is being provided through existing documents, including the Combustible Dust National Emphasis Program Directive CPL 03-00-008, which includes an operative definition, as well as provides information about current responsibilities in this area. In addition, there are a number of voluntary industry consensus standards (particularly those of the NFPA) that address combustible dust.

- In the final HCS, combustible dust hazards must be addressed on labels and SDSs. Label elements are provided for combustible dust in the final HCS and include the signal word "warning" and the hazard statement "May form combustible dust concentrations in the air".

  For chemicals in a solid form that do not present a combustible dust hazard, but may form combustible dusts while being processed in normal downstream uses, paragraph (f)(4) of the HCS allows the chemical manufacturer some flexibility in labeling requirements. The manufacturer or importer to may transmit the label to the customer at the time of the initial shipment, but the label does not need to be included with subsequent shipments unless it changes. This provides the needed information to the downstream users on the potential hazards in the workplace, while acknowledging that the solid metal or other materials do not present the same hazards that are produced when these materials are processed under normal conditions of use.

How many businesses and workers would be affected by the revised Hazard Communication Standard?

OSHA estimates that over 5 million workplaces in the United States would be affected by the revised Hazard Communication Standard (HCS). These are all those workplaces where employees—a total of approximately 43 million of them—could be exposed to hazardous chemicals. Included among these 5 million workplaces are an estimated 90,000 establishments that create hazardous chemicals; these chemical producers employ almost 3 million workers.

What are the estimated overall costs for industry to comply with the revised Hazard Communication Standard?

The revised Hazard Communications Standard's (HCS) total cost, an estimated $201 million a year on an annualized basis for the entire United States, is the sum of four major cost elements. (1) OSHA estimates that the cost of classifying chemical hazards in accordance with the GHS criteria and revising safety data sheets and labels to meet new format and content requirements would be $22.5 million a year on an annualized basis. (2) OSHA estimates that training for employees to become familiar with new warning symbols and the revised safety data sheet format under GHS would cost $95.4 million a year on an annualized basis. (3) OSHA estimated annualized costs of $59 million a year for management to become familiar with the new GHS system and to engage in other management-related activities as may be necessary for industry's adoption of GHS. (4) OSHA estimated annualized costs of $24.1 million for printing packaging and labels for hazardous chemicals in color.

What are the estimated benefits attributable to the revised Hazard Communication Standard?
OSHA expects that the modifications to the Hazard Communication Standard (HCS) will result in increased safety and health for the affected employees and reduce the numbers of accidents, fatalities, injuries, and illnesses associated with exposures to hazardous chemicals. The GHS revisions to the HCS standard for labeling and safety data sheets would enable employees exposed to workplace chemicals to more quickly obtain and to more easily understand information about the hazards associated with those chemicals.

In addition, the revisions to HCS are expected to improve the use of appropriate exposure controls and work practices that can reduce the safety and health risks associated with exposure to hazardous chemicals.

OSHA estimates that the revised HCS will result in the prevention of 43 fatalities and 585 injuries and illnesses (318 non-lost-workday injuries and illnesses, 203 lost-workday injuries and illnesses, and 64 chronic illnesses) annually. The monetized value of this reduction in occupational risks is an estimated $250 million a year on an annualized basis.

OSHA estimates that the revised HCS will result in savings of $475.2 million from productivity improvements for health and safety managers and logistics personnel, $32.2 million during periodic updating of SDSs and labels, and $285.3 million from simplified hazard communication training.

OSHA anticipates that, in addition to safety and health benefits, the revised HCS will result in four types of productivity benefits: (1) for chemical manufacturers, because they will need to produce fewer SDSs in future years; (2) for employers, in providing training to new employees as required by the existing OSHA HCS through the improved consistency of the labels and SDSs. (3) for firms engaging in, or considering engaging in, international trade.

I understand that the United Nations revises the GHS every two years. How will OSHA manage and communicate changes to the Hazard Communication Standard?
It is expected that the GHS will be a living document and is expected to remain up-to-date and relevant; therefore further changes may be adopted on a two year cycle. Presently most of the recent updates have been clarification of text. However, OSHA anticipates that future updates of the Hazard Communication Standard (HCS) may be necessary and can be done through various rulemaking options, including:

- **Technical updates** for minor terminology changes,
- **Direct Final Rules** for text clarification, and
- **Notice and Comment rulemaking** for more substantive or controversial updates such as additional criteria or changes in health or safety hazard classes or categories.

The NEW OSHA Hazard Communication Standard (HCS)

Note: The following text for 1910.1200 has been updated to align with the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Revision 3, issued in the Federal Register, March 26, 2012. This rule became effective May 25, 2012.

Also, the Hazard Communication page, on OSHA.gov, includes downloadable versions of the revised 1910.1200 Final Rule and appendices, updated to align with the GHS; a comparison of the Hazard Communication Standard, issued in 1994 (HazCom 1994), with the revised Hazard Communication Final Rule issued in 2012 (HazCom 2012); frequently asked questions on the revisions; and new guidance materials on the revisions. The page also contains the full regulatory text and appendices of HazCom 1994.

1910.1200(a)(1)
The purpose of this section is to ensure that the hazards of all chemicals produced or imported are classified, and that information concerning the classified hazards is transmitted to employers and employees. The requirements of this section are intended to be consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Revision 3. The transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, safety data sheets and employee training.

1910.1200(a)(2)
This occupational safety and health standard is intended to address comprehensively the issue of classifying the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legislative or regulatory enactments of a state, or political subdivision of a state, pertaining to this subject. Classifying the potential hazards of chemicals and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

1910.1200(b)(1)
This section requires chemical manufacturers or importers to classify the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers. (Employers who do not produce or import chemicals need only focus on those parts of this rule that deal with establishing a workplace program and communicating information to their workers.)

1910.1200(b)(2)
This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

1910.1200(b)(3)
This section applies to laboratories only as follows:

1910.1200(b)(3)(i)
Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(3)(ii)
Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible during each workshift to laboratory employees when they are in their work areas;

1910.1200(b)(3)(iii)
Employers shall ensure that laboratory employees are provided information and training in accordance with paragraph (h) of this section, except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section; and,

1910.1200(b)(3)(iv)
Laboratory employers that ship hazardous chemicals are considered to be either a chemical manufacturer or a distributor under this rule, and thus must ensure that any containers of hazardous chemicals leaving the laboratory are labeled in accordance with paragraph (f) of this section, and that a safety data sheet is provided to distributors and other employers in accordance with paragraphs (g)(6) and (g)(7) of this section.

1910.1200(b)(4)
In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

1910.1200(b)(4)(i)
Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(4)(ii)
Employers shall maintain copies of any safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a safety data sheet as soon as possible for sealed containers of hazardous chemicals received without a safety data sheet if an employee requests the safety data sheet, and shall ensure that the safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

1910.1200(b)(4)(iii)
Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

1910.1200(b)(5)
This section does not require labeling of the following chemicals:

1910.1200(b)(5)(i)
Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 *et seq*.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(ii)
Any chemical substance or mixture as such terms are defined in the Toxic Substances Control Act (15 U.S.C. 2601 *et seq*.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(iii)
Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device or product, including materials intended for use as ingredients in such products (*e.g.* flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq*.) or the Virus-Serum-Toxin Act of 1913 (21 U.S.C. 151 *et seq*.), and regulations issued under those Acts, when they are subject to the labeling requirements under those Acts by either the Food and Drug Administration or the Department of Agriculture;

1910.1200(b)(5)(iv)
Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 et seq.) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol, Tobacco, Firearms and Explosives;

1910.1200(b)(5)(v)
Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq*.) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq*.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission; and,

1910.1200(b)(5)(vi)
Agricultural or vegetable seed treated with pesticides and labeled in accordance with the Federal Seed Act (7 U.S.C. 1551 *et seq*.) and the labeling regulations issued under that Act by the Department of Agriculture.

1910.1200(b)(6)(i)
Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 *et seq*.), when subject to regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(6)(ii)
Any hazardous substance as such term is defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.) when the hazardous substance is the focus of remedial or removal action being conducted under CERCLA in accordance with Environmental Protection Agency regulations.

1910.1200(b)(6)(iii)
Tobacco or tobacco products;

1910.1200(b)(6)(iv)
Wood or wood products, including lumber which will not be processed, where the chemical manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility (wood or wood products which have been treated with a hazardous chemical covered by this standard, and wood which may be subsequently sawed or cut, generating dust, are not exempted);

1910.1200(b)(6)(v)
Articles (as that term is defined in paragraph (c) of this section);

1910.1200(b)(6)(vi)
Food or alcoholic beverages which are sold, used, or prepared in a retail establishment (such as a grocery store, restaurant, or drinking place), and foods intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(vii)
Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq*.), when it is in solid, final form for direct administration to the patient (*e.g.*, tablets or pills); drugs which are packaged by the chemical manufacturer for sale to consumers in a retail establishment (*e.g.*, over-the-counter drugs); and drugs intended for personal consumption by employees while in the workplace (*e.g.*, first aid supplies);

1910.1200(b)(6)(viii)
Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(ix)
Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq*.) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq*.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended;

1910.1200(b)(6)(x)
Nuisance particulates where the chemical manufacturer or importer can establish that they do not pose any physical or health hazard covered under this section;

1910.1200(b)(6)(xi)
Ionizing and nonionizing radiation; and,

1910.1200(b)(6)(xii)
Biological hazards.

1910.1200(c)
Definitions. *Article* means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, *e.g.*, minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Chemical means any substance, or mixture of substances.

Chemical manufacturer means an employer with a workplace where chemical(s) are produced for use or distribution.

Chemical name means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name that will clearly identify the chemical for the purpose of conducting a hazard classification.

Classification means to identify the relevant data regarding the hazards of a chemical; review those data to ascertain the hazards associated with the chemical; and decide whether the chemical will be classified as hazardous according to the definition of hazardous chemical in this section. In addition, classification for health and physical hazards includes the determination of the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

Commercial account means an arrangement whereby a retail distributor sells hazardous chemicals to an employer, generally in large quantities over time and/or at costs that are below the regular retail price.

Common name means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

Designated representative means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Distributor means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

Employee means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

Employer means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

Exposure or exposed means that an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (*e.g.* accidental or possible) exposure. "Subjected" in terms of health hazards includes any route of entry (*e.g.* inhalation, ingestion, skin contact or absorption.)

Foreseeable emergency means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

Hazard category means the division of criteria within each hazard class, e.g., oral acute toxicity and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

Hazard class means the nature of the physical or health hazards, e.g., flammable solid, carcinogen, oral acute toxicity.

Hazard not otherwise classified (HNOC) means an adverse physical or health effect identified through evaluation of scientific evidence during the classification process that does not meet the specified criteria for the physical and health hazard classes addressed in this section. This does not extend coverage to adverse physical and health effects for which there is a hazard class addressed in this section, but the effect either falls below the cut-off value/concentration limit of the hazard class or is under a GHS hazard category that has not been adopted by OSHA (e.g., acute toxicity Category 5).

Hazard statement means a statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

Hazardous chemical means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

Health hazard means a chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A to §1910.1200—Health Hazard Criteria.

Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

Importer means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

Label means an appropriate group of written, printed or graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached to the immediate container of a hazardous chemical, or to the outside packaging.

Label elements means the specified pictogram, hazard statement, signal word and precautionary statement for each hazard class and category.

Mixture means a combination or a solution composed of two or more substances in which they do not react.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; or in contact with water emits flammable gas. See Appendix B to §1910.1200—Physical Hazard Criteria.

Pictogram means a composition that may include a symbol plus other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical. Eight pictograms are designated under this standard for application to a hazard category.

Precautionary statement means a phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical, or improper storage or handling.

Produce means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

Product identifier means the name or number used for a hazardous chemical on a label or in the SDS. It provides a unique means by which the user can identify the chemical. The product identifier used shall permit cross-references to be made among the list of hazardous chemicals required in the written hazard communication program, the label and the SDS.

Pyrophoric gas means a chemical in a gaseous state that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.

Responsible party means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

Safety data sheet (SDS) means written or printed material concerning a hazardous chemical that is prepared in accordance with paragraph (g) of this section.

Signal word means a word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used in this section are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for the less severe.

Simple asphyxiant means a substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death.

Specific chemical identity means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

Substance means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix E to §1910.1200—Definition of Trade Secret, sets out the criteria to be used in evaluating trade secrets.

Use means to package, handle, react, emit, extract, generate as a byproduct, or transfer.

Work area means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

Workplace means an establishment, job site, or project, at one geographical location containing one or more work areas.

1910.1200(d)
Hazard classification.
1910.1200(d)(1)
Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to classify the chemicals in accordance with this section. For each chemical, the chemical manufacturer or importer shall determine the hazard classes, and, where appropriate, the category of each class that apply to the chemical being classified. Employers are not required to classify chemicals unless they choose not to rely on the classification performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

1910.1200(d)(2)
Chemical manufacturers, importers or employers classifying chemicals shall identify and consider the full range of available scientific literature and other evidence concerning the potential hazards. There is no requirement to test the chemical to determine how to classify its hazards. Appendix A to § 1910.1200 shall be consulted for classification of health hazards, and Appendix B to § 1910.1200 shall be consulted for the classification of physical hazards.

1910.1200(d)(3)
Mixtures.
1910.1200(d)(3)(i)
Chemical manufacturers, importers, or employers evaluating chemicals shall follow the procedures described in Appendices A and B to Sec. 1910.1200 to classify the hazards of the chemicals, including determinations regarding when mixtures of the classified chemicals are covered by this section.

1910.1200(d)(3)(ii)
When classifying mixtures they produce or import, chemical manufacturers and importers of mixtures may rely on the information provided on the current safety data sheets of the individual ingredients, except where the chemical manufacturer or importer knows, or in the exercise of reasonable diligence should know, that the safety data sheet misstates or omits information required by this section.

1910.1200(d)(4)
Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

1910.1200(d)(4)(i)
National Toxicology Program (NTP), *Annual Report on Carcinogens* (latest edition);

1910.1200(d)(4)(ii)
International Agency for Research on Cancer (IARC) *Monographs* (latest editions); or

1910.1200(d)(4)(iii)
29 CFR part 1910, subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

Note: The *Registry of Toxic Effects of Chemical Substances* published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

1910.1200(d)(5)
The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

1910.1200(d)(5)(i)
If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

1910.1200(d)(5)(ii)
If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under paragraph (d)(4) of this section;

1910.1200(d)(5)(iii)
If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and,

1910.1200(d)(5)(iv)
If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health risk to employees in those concentrations, the mixture shall be assumed to present the same hazard.

1910.1200(d)(6)
Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director. The written description may be incorporated into the written hazard communication program required under paragraph (e) of this section.

1910.1200(e)
Written hazard communication program.
1910.1200(e)(1)
Employers shall develop, implement, and maintain at each workplace, a written hazard communication program which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, safety data sheets, and employee information and training will be met, and which also includes the following:

1910.1200(e)(1)(i)
A list of the hazardous chemicals known to be present using a product identifier that is referenced on the appropriate safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

1910.1200(e)(1)(ii)
The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

1910.1200(e)(2)
Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

1910.1200(e)(2)(i)
The methods the employer will use to provide the other employer(s) on-site access to safety data sheets for each hazardous chemical the other employer(s)' employees may be exposed to while working;

1910.1200(e)(2)(ii)
The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

1910.1200(e)(2)(iii)
The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

1910.1200(e)(3)
The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

1910.1200(e)(4)
The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.1020 (e).

1910.1200(e)(5)
Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the written hazard communication program may be kept at the primary workplace facility.

1910.1200(f)
Labels and other forms of warning—

1910.1200(f)(1)
Labels on shipped containers. The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked. Hazards not otherwise classified do not have to be addressed on the container. Where the chemical manufacturer or importer is required to label, tag or mark the following information shall be provided:

1910.1200(f)(1)(i)
Product identifier;
1910.1200(f)(1)(ii)
Signal word;
1910.1200(f)(1)(iii)
Hazard statement(s);
1910.1200(f)(1)(iv)
Pictogram(s);
1910.1200(f)(1)(v)
Precautionary statement(s); and,

1910.1200(f)(1)(vi)
Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

1910.1200(f)(2)
The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(i) through (v) of this section is in accordance with Appendix C to § 1910.1200, for each hazard class and associated hazard category for the hazardous chemical, prominently displayed, and in English (other languages may also be included if appropriate).

1910.1200(f)(3)
The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(ii) through (iv) of this section is located together on the label, tag, or mark.

1910.1200(f)(4)

Solid materials.

1910.1200(f)(4)(i)

For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

1910.1200(f)(4)(ii)

The label may be transmitted with the initial shipment itself, or with the safety data sheet that is to be provided prior to or at the time of the first shipment; and,

1910.1200(f)(4)(iii)

This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself, and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grains).

1910.1200(f)(5)

Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 *et seq*.) and regulations issued under that Act by the Department of Transportation.

1910.1200(f)(6)

Workplace labeling. Except as provided in paragraphs (f)(7) and (f)(8) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with either:

1910.1200(f)(6)(i)

The information specified under paragraphs (f)(1)(i) through (v) of this section for labels on shipped containers; or,

1910.1200(f)(6)(ii)
Product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards of the hazardous chemical.

1910.1200(f)(7)
The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(6) of this section to be on a label. The employer shall ensure the written materials are readily accessible to the employees in their work area throughout each work shift.

1910.1200(f)(8)
The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. For purposes of this section, drugs which are dispensed by a pharmacy to a health care provider for direct administration to a patient are exempted from labeling.

1910.1200(f)(9)
The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

1910.1200(f)(10)
The employer shall ensure that workplace labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

1910.1200(f)(11)
Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within six months of becoming aware of the new information, and shall ensure that labels on containers of hazardous chemicals shipped after that time contain the new information. If the chemical is not currently produced or imported, the chemical manufacturer, importer, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

1910.1200(g)
Safety data sheets.
1910.1200(g)(1)
Chemical manufacturers and importers shall obtain or develop a safety data sheet for each hazardous chemical they produce or import. Employers shall have a safety data sheet in the workplace for each hazardous chemical which they use.

1910.1200(g)(2)
The chemical manufacturer or importer preparing the safety data sheet shall ensure that it is in English (although the employer may maintain copies in other languages as well), and includes at least the following section numbers and headings, and associated information under each heading, in the order listed (*See* Appendix D to § 1910.1200—Safety Data Sheets, for the specific content of each section of the safety data sheet):
1910.1200(g)(2)(i)
Section 1, Identification;
1910.1200(g)(2)(ii)
Section 2, Hazard(s) identification;
1910.1200(g)(2)(iii)
Section 3, Composition/information on ingredients;
1910.1200(g)(2)(iv)
Section 4, First-aid measures;
1910.1200(g)(2)(v)
Section 5, Fire-fighting measures;

1910.1200(g)(2)(vi)
Section 6, Accidental release measures;
1910.1200(g)(2)(vii)
Section 7, Handling and storage;
1910.1200(g)(2)(viii)
Section 8, Exposure controls/personal protection;
1910.1200(g)(2)(ix)
Section 9, Physical and chemical properties;
1910.1200(g)(2)(x)
Section 10, Stability and reactivity;

1910.1200(g)(2)(xi)
Section 11, Toxicological information;

1910.1200(g)(2)(xii)
Section 12, Ecological information;
1910.1200(g)(2)(xiii)
Section 13, Disposal considerations;
1910.1200(g)(2)(xiv)
Section 14, Transport information;
1910.1200(g)(2)(xv)
Section 15, Regulatory information; and
1910.1200(g)(2)(xvi)
Section 16, Other information, including date of preparation or last revision.

Note 1 to paragraph (g)(2): To be consistent with the GHS, an SDS must also include the headings in paragraphs (g)(2)(xii) through (g)(2)(xv) in order.

Note 2 to paragraph (g)(2): OSHA will not be enforcing information requirements in sections 12 through 15, as these areas are not under its jurisdiction.

1910.1200(g)(3)
If no relevant information is found for any sub-heading within a section on the safety data sheet, the chemical manufacturer, importer or employer preparing the safety data sheet shall mark it to indicate that no applicable information was found.

1910.1200(g)(4)
Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one safety data sheet to apply to all of these similar mixtures.

1910.1200(g)(5)
The chemical manufacturer, importer or employer preparing the safety data sheet shall ensure that the information provided accurately reflects the scientific evidence used in making the hazard classification. If the chemical manufacturer, importer or employer preparing the safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the safety data sheet within three months. If the chemical is not currently being produced or imported, the chemical manufacturer or importer shall add the information to the safety data sheet before the chemical is introduced into the workplace again.

1910.1200(g)(6)(i)
Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate safety data sheet with their initial shipment, and with the first shipment after a safety data sheet is updated;

1910.1200(g)(6)(ii)
The chemical manufacturer or importer shall either provide safety data sheets with the shipped containers or send them to the distributor or employer prior to or at the time of the shipment;

1910.1200(g)(6)(iii)
If the safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the distributor or employer shall obtain one from the chemical manufacturer or importer as soon as possible; and,

1910.1200(g)(6)(iv)
The chemical manufacturer or importer shall also provide distributors or employers with a safety data sheet upon request.

1910.1200(g)(7)(i)
Distributors shall ensure that safety data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a safety data sheet is updated;

1910.1200(g)(7)(ii)
The distributor shall either provide safety data sheets with the shipped containers, or send them to the other distributor or employer prior to or at the time of the shipment;

1910.1200(g)(7)(iii)
Retail distributors selling hazardous chemicals to employers having a commercial account shall provide a safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a safety data sheet is available;

1910.1200(g)(7)(iv)
Wholesale distributors selling hazardous chemicals to employers over-the-counter may also provide safety data sheets upon the request of the employer at the time of the over-the-counter purchase, and shall post a sign or otherwise inform such employers that a safety data sheet is available;

1910.1200(g)(7)(v)
If an employer without a commercial account purchases a hazardous chemical from a retail distributor not required to have safety data sheets on file (i.e., the retail distributor does not have commercial accounts and does not use the materials), the retail distributor shall provide the employer, upon request, with the name, address, and telephone number of the chemical manufacturer, importer, or distributor from which a safety data sheet can be obtained;

1910.1200(g)(7)(vi)
Wholesale distributors shall also provide safety data sheets to employers or other distributors upon request; and,

1910.1200(g)(7)(vii)
Chemical manufacturers, importers, and distributors need not provide safety data sheets to retail distributors that have informed them that the retail distributor does not sell the product to commercial accounts or open the sealed container to use it in their own workplaces.

1910.1200(g)(8)
The employer shall maintain in the workplace copies of the required safety data sheets for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s). (Electronic access and other alternatives to maintaining paper copies of the safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options.)

1910.1200(g)(9)
Where employees must travel between workplaces during a workshift, *i.e.*, their work is carried out at more than one geographical location, the material safety data sheets may be kept at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

1910.1200(g)(10)
Safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work area(s).

1910.1200(g)(11)
Safety data sheets shall also be made readily available, upon request, to designated representatives, the Assistant Secretary, and the Director, in accordance with the requirements of § 1910.1020(e).

1910.1200(h)
Employee information and training.
1910.1200(h)(1)
Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new chemical hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and safety data sheets.
1910.1200(h)(2)
Information. Employees shall be informed of:
1910.1200(h)(2)(i)
The requirements of this section;
1910.1200(h)(2)(ii)
Any operations in their work area where hazardous chemicals are present; and,
1910.1200(h)(2)(iii)
The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and safety data sheets required by this section.

1910. 1910.1200(f)(11)1200(h)(3)
Training. Employee training shall include at least:
1910.1200(h)(3)(i)
Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
1910.1200(h)(3)(ii)
The physical, health, simple asphyxiation, combustible dust, and pyrophoric gas hazards, as well as hazards not otherwise classified, of the chemicals in the work area;
1910.1200(h)(3)(iii)
The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,
1910.1200(h)(3)(iv)
The details of the hazard communication program developed by the employer, including an explanation of the labels received on shipped containers and the workplace labeling system used by their employer; the safety data sheet, including the order of information and how employees can obtain and use the appropriate hazard information.

1910.1200(i)
Trade secrets.
1910.1200(i)(1)
The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name, other specific identification of a hazardous chemical, or the exact percentage (concentration) of the substance in a mixture, from the safety data sheet, provided that:
1910.1200(i)(1)(i)
The claim that the information withheld is a trade secret can be supported;
1910.1200(i)(1)(ii)
Information contained in the safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;
1910.1200(i)(1)(iii)
The safety data sheet indicates that the specific chemical identity and/or percentage of composition is being withheld as a trade secret; and,
1910.1200(i)(1)(iv)
The specific chemical identity and percentage is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph (i).
1910.1200(i)(2)
Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity and/or specific percentage of composition of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity or percentage composition of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.
1910.1200(i)(3)
In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity or percentage composition, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:
1910.1200(i)(3)(i)
The request is in writing;
1910.1200(i)(3)(ii)
The request describes with reasonable detail one or more of the following occupational health needs for the information:
1910.1200(i)(3)(ii)(A)
To assess the hazards of the chemicals to which employees will be exposed;
1910.1200(i)(3)(ii)(B)
To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;
1910.1200(i)(3)(ii)(C)
To conduct pre-assignment or periodic medical surveillance of exposed employees;
1910.1200(i)(3)(ii)(D)
To provide medical treatment to exposed employees;
1910.1200(i)(3)(ii)(E)

To select or assess appropriate personal protective equipment for exposed employees;
1910.1200(i)(3)(ii)(F)
To design or assess engineering controls or other protective measures for exposed employees; and,
1910.1200(i)(3)(ii)(G)
To conduct studies to determine the health effects of exposure.
1910.1200(i)(3)(iii)
The request explains in detail why the disclosure of the specific chemical identity or percentage composition is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:
1910.1200(i)(3)(iii)(A)
The properties and effects of the chemical;
1910.1200(i)(3)(iii)(B)
Measures for controlling workers' exposure to the chemical;
1910.1200(i)(3)(iii)(C)
Methods of monitoring and analyzing worker exposure to the chemical; and,
1910.1200(i)(3)(iii)(D)
Methods of diagnosing and treating harmful exposures to the chemical;
1910.1200(i)(3)(iv)
The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,
1910.1200(i)(3)(v)
The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.
1910.1200(i)(4)
The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:
1910.1200(i)(4)(i)
May restrict the use of the information to the health purposes indicated in the written statement of need;
1910.1200(i)(4)(ii)
May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,
1910.1200(i)(4)(iii)
May not include requirements for the posting of a penalty bond.
1910.1200(i)(5)
Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.
1910.1200(i)(6)
If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

1910.1200(i)(7)
If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity or percentage composition, the denial must:
1910.1200(i)(7)(i)
Be provided to the health professional, employee, or designated representative, within thirty days of the request;
1910.1200(i)(7)(ii)
Be in writing;
1910.1200(i)(7)(iii)
Include evidence to support the claim that the specific chemical identity or percent of composition is a trade secret;
1910.1200(i)(7)(iv)
State the specific reasons why the request is being denied; and,
1910.1200(i)(7)(v)
Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the trade secret.
1910.1200(i)(8)
The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.
1910.1200(i)(9)
When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:
1910.1200(i)(9)(i)
The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity or percentage composition is a trade secret;
1910.1200(i)(9)(ii)
The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,
1910.1200(i)(9)(iii)
The health professional, employee or designated representative has demonstrated adequate means to protect the confidentiality.
1910.1200(i)(10)(i)
If OSHA determines that the specific chemical identity or percentage composition requested under paragraph (i)(3) of this section is not a "bona fide" trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.
1910.1200(i)(10)(ii)
If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

1910.1200(i)(11)
If a citation for a failure to release trade secret information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation "in camera" or issue appropriate orders to protect the confidentiality of such matters.
1910.1200(i)(12)
Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.
1910.1200(i)(13)
Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process information which is a trade secret.

1910.1200(j)
Effective dates.
1910.1200(j)(1)
Employers shall train employees regarding the new label elements and safety data sheets format by December 1, 2013.
1910.1200(j)(2)
Chemical manufacturers, importers, distributors, and employers shall be in compliance with all modified provisions of this section no later than June 1, 2015, except:
1910.1200(j)(2)(i)
After December 1, 2015, the distributor shall not ship containers labeled by the chemical manufacturer or importer unless the label has been modified to comply with paragraph (f)(1) of this section.
1910.1200(j)(2)(ii)
All employers shall, as necessary, update any alternative workplace labeling used under paragraph (f)(6) of this section, update the hazard communication program required by paragraph (h)(1), and provide any additional employee training in accordance with paragraph (h)(3) for newly identified physical or health hazards no later than June 1, 2016.
1910.1200(j)(3)
Chemical manufacturers, importers, distributors, and employers may comply with either § 1910.1200 revised as of October 1, 2011, or the current version of this standard, or both during the transition period.

[59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 5507, Feb. 13, 1996; 77 FR 17785, March 26, 2012]

Different Types of Chemical Hazards

Chemicals cause health hazards if they are:

- ✓ **Target organ chemicals**—they injure specific organs in your body.
- ✓ **Toxic**—cause illness or death. Toxic chemicals are determined on the basis of tests on laboratory animals that are exposed to a given chemical through either inhalation, ingestion, or skin absorption.
- ✓ **Corrosive**—can destroy your skin or eyes.
- ✓ **Irritants**—cause reversible inflammation when they make contact with living tissue.
- ✓ **Carcinogens**—have been known to cause cancer or have the potential of causing cancer in humans.
- ✓ **Sensitizers**—can cause an allergic reaction on subsequent repeated exposures.
- ✓ **Neurotoxins**—produce toxic effects primarily on the central nervous system.
- ✓ **Nephrotoxins**—Produce toxic effects on kidneys.
- ✓ **Reproductive toxins**—have the potential to adversely affect the reproductive system.
- ✓ **Hepatotoxins**—can adversely affect the liver.
- ✓ **Lung hazards**—can irritate or damage pulmonary tissue.
- ✓ **Skin hazards**—can affect the dermal layer of the body, resulting in rashes and irritation.
- ✓ **Eye hazards**—can adversely affect the eye or diminish the visual capacity of a human.
- ✓ **Blood system hazards**—caused by chemicals that decrease the hemoglobin function; depriving of oxygen. Chemicals that present physical hazards and are covered by the Hazard Communication Standard include combustible liquids, flammable materials, all compressed gases, explosives, organic peroxides, oxidizers, pyrophoric materials, unstable materials, and water-reactive materials.
- ✓ **Fire hazards**—chemicals that have the potential for creating a fire or aiding an ongoing fire. These materials are flammables, combustibles, oxidizers, pyrophoric materials, and organic peroxides.
    - o **Flammables**—catch fire quickly.
    - o **Oxidizers**—capable of initiating or promoting a fire in other compounds by the release of oxygen or other gases.

- **Pyrophoric materials**—can be ignited as a result of contact with oxygen in the absence of an ignition source at temperature below 130°F.
- **Organic peroxides**—contain both fuel, in the form of carbon, and excess oxygen, and thus can pose a severe fire hazard.
- **Compressed gases**—all compressed gases pose a physical hazard.
- **Explosive materials**—can be decomposed in a violent chemical reaction with the production of heat, pressure, and large quantities of gas.
- **Unstable materials**—certain compounds in their pure form can undergo vigorous decomposition or polymerization under moderate conditions of shock, pressure, or temperature.
- **Water-reactive compounds**—can react vigorously with water to produce a toxic or flammable gas.

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train employees. OSHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. OSHA compliance officers will be talking to employees to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and SDSs.

Identifying Hazardous Chemicals

Chemical manufacturers have to let users know about hazards. They do this by providing, for each product, a container label which gives a quick overview of the chemical, and an MSDS which offers more complete information.

Label Information
Hazardous chemical containers are labeled by the manufacturer. The label format may differ from company to company, but all labels must contain the same information. This makes it easy to determine at a glance a chemical's possible hazards and the basic steps that employees must take to protect themselves.

The label may use words or symbols to tell you:

- ✓ The chemical's identity and its components (unless they're part of the manufacturer's trade secrets, which do not have to be revealed)
- ✓ The name and address of the company that made or imported the chemical
- ✓ Specific hazard warnings, such as physical or health hazards. Labels may also include:
- ✓ Precautionary measures, such as basic protective clothing, equipment, and procedures to work safely
- ✓ Proper handling and storage instructions
- ✓ First-aid instructions
- ✓ Special instructions concerning children

SDS Information
Each company should have on file an MSDS for every chemical and hazardous product in the workplace. MSDSs describe everything an employee needs to know about the chemical.

Employees must read the SDS before starting a job to know what they're working with and how to handle it safely. Though individual SDSs may give a different amount of information, they all contain similar types of information.

Fire, Explosion, and Reactivity Hazards
Some chemicals present physical hazards such as the potential for fire, explosion, and reactivity. The MSDS explains these physical hazards.

- ✓ **Flammable chemicals**—catch fire easily. The MSDS will tell if it's flammable.
- ✓ **Flash point**—the minimum temperature at which a liquid gives off enough vapors to burn. The lower the flash point, the more flammable the substance.
- ✓ **Flammable limits**—the range of concentration of a substance in the air within which a substance can readily catch fire. Concentrations below or above the limits are less likely to ignite or burn.

Common SDS Definitions

Health Hazards

acute: resulting from a single exposure to a toxic or hazardous chemical.

allergen: a substance capable of causing an allergic response. An allergic response is an abnormal response of a hypersensitive person to chemical and physical stimuli.

biohazardous: describes an agent that is biological in nature and capable of self-replication and that has the capacity to produce deleterious effects on other biological organisms, particularly humans.

carcinogenic: describes a material capable of producing cancer in test animals and/or humans.

chronic: resulting from repeated exposure to sub-lethal doses of toxic or hazardous chemicals over a period of time.

cytotoxic: describes chemicals toxic to cells because of DNA disruption.

hazardous chemical: any chemical that is a physical or health hazard. The degree of hazard is generally based upon the extent of exposure or usage.

irritant: a non-corrosive material that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact as a function of concentration or duration of exposure.

material safety data sheet (**MSDS**): written or printed material about a hazardous chemical.

mutagenic: capable of producing genetic changes in animals and/or humans that are passed on to future generations of offspring.

reproductive toxin: any agent that has a harmful effect on the adult male or female reproductive system or a developing fetus or child. Such hazards have a variety of effects on people, including loss of sexual drive, mental disorders, impotence, infertility, sterility, mutagenic effects on germ cells, teratogenic effects on a fetus, and transplacental carcinogenesis.

sensitizer: a material that on first exposure causes little or no reaction in humans or test animals but that after repeated exposure may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form. Respiratory sensitization to a few chemicals is also known to occur.

target organ effect: effects on specifically listed organs and systems, such as the liver, kidneys, nervous system, lungs, skin, and eyes, caused by exposure to a material.

teratogenic: describes a material capable of producing birth defects in animals and humans.

toxicity: the ability of a chemical to do harm to the human organism.

Physical Hazards

asphyxiant: a vapor or gas that can cause unconsciousness or death due to lack of oxygen. Most simple asphyxiants are harmful to the body only when they become so concentrated that they reduce the available oxygen to 18 percent of air.

boiling point: temperature at which a liquid boils or changes to a vapor.

combustible liquid: combustible liquids have a flash point of 100°F (38°C) or higher. Non-liquid materials, such as wood or paper, are classified as ordinary combustibles.

corrosive: a chemical that causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact; a liquid that causes a severe corrosion rate in steel.

explosive: a chemical that causes sudden or instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

flammable liquid: defined as a liquid with a flash point below 100°F (38°C), a liquid that gives off vapors readily ignitable at room temperature.

oxidizer: a substance that yields oxygen readily to stimulate the combustion of other materials.

polymerization: a condition that occurs when a substance reacts with itself and releases heat that can lead to an explosion.

pyrophoric: capable of spontaneous ignition when exposed to air at temperatures of 130°F or below.

radioactive material: material that emits energy as alpha, beta, or gamma radiation from the nucleus of an atom. Always involves changes of one kind of atom into a different kind.

reactive material: a chemical substance or mixture that vigorously polymerizes, decomposes, condenses, or becomes self-reactive due to shock, pressure, or temperature. Includes materials or mixtures that fall within any of these categories: (1) organic peroxide, (2) pressure-generating material, and (3) water reactive material.

specific gravity: a mass-to-volume comparison relative to water (1). A specific gravity below 1 will float in water, above 1 will sink.

unstable reactive: a chemical that in its pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, or temperature.

vapor density: compares a chemical's vapor density to air density (1). A vapor below 1 will rise in air, above 1 will sink.

vapor pressure: the higher the number, the faster a chemical evaporates, increasing inhalation risk.

water reactive agent: a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Hazardous Limits

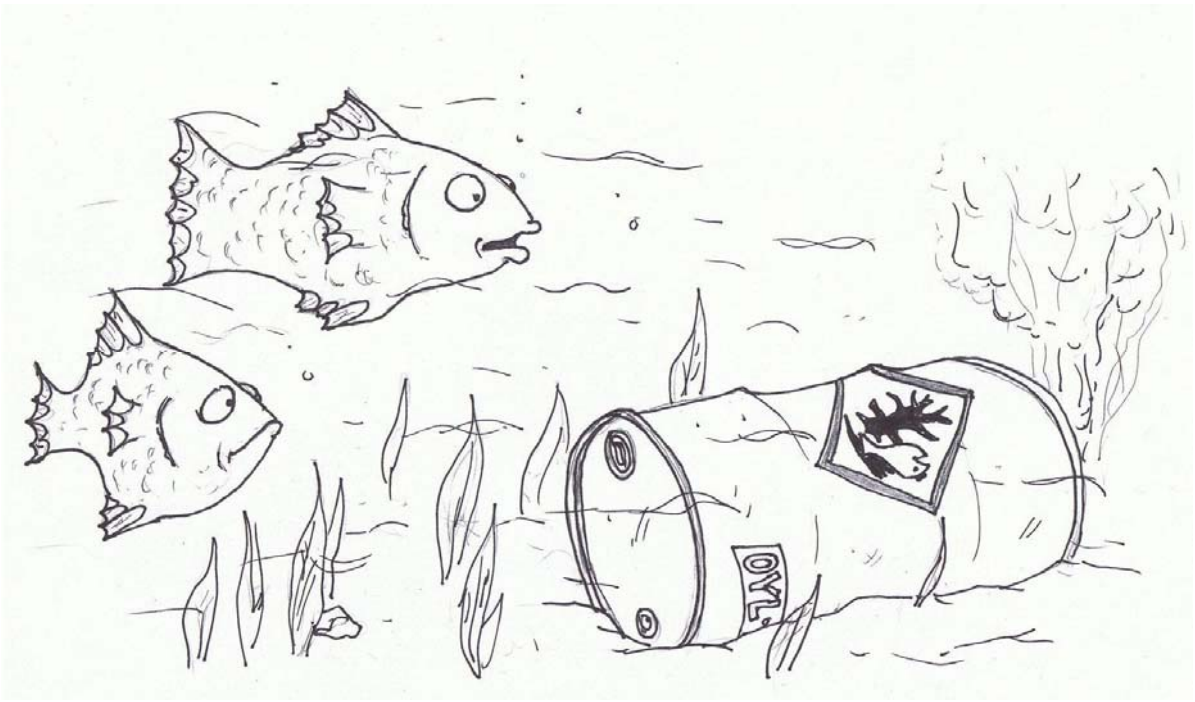
flash point: the lowest temperature at which a liquid gives off enough vapors to allow ignition

lower explosive limit (LEL): the lowest end of the range at which the gas or vapor level is sufficient to burn or explode if exposed to an ignition source. Below that level the mixture is too lean to burn.

permissible exposure limit (PEL): the averaged maximum concentration of a chemical in the air that a person can be exposed to repeatedly without developing health problems. Generally expressed in parts per million (ppm). Concentrations at or above the PEL make respiratory protection mandatory.

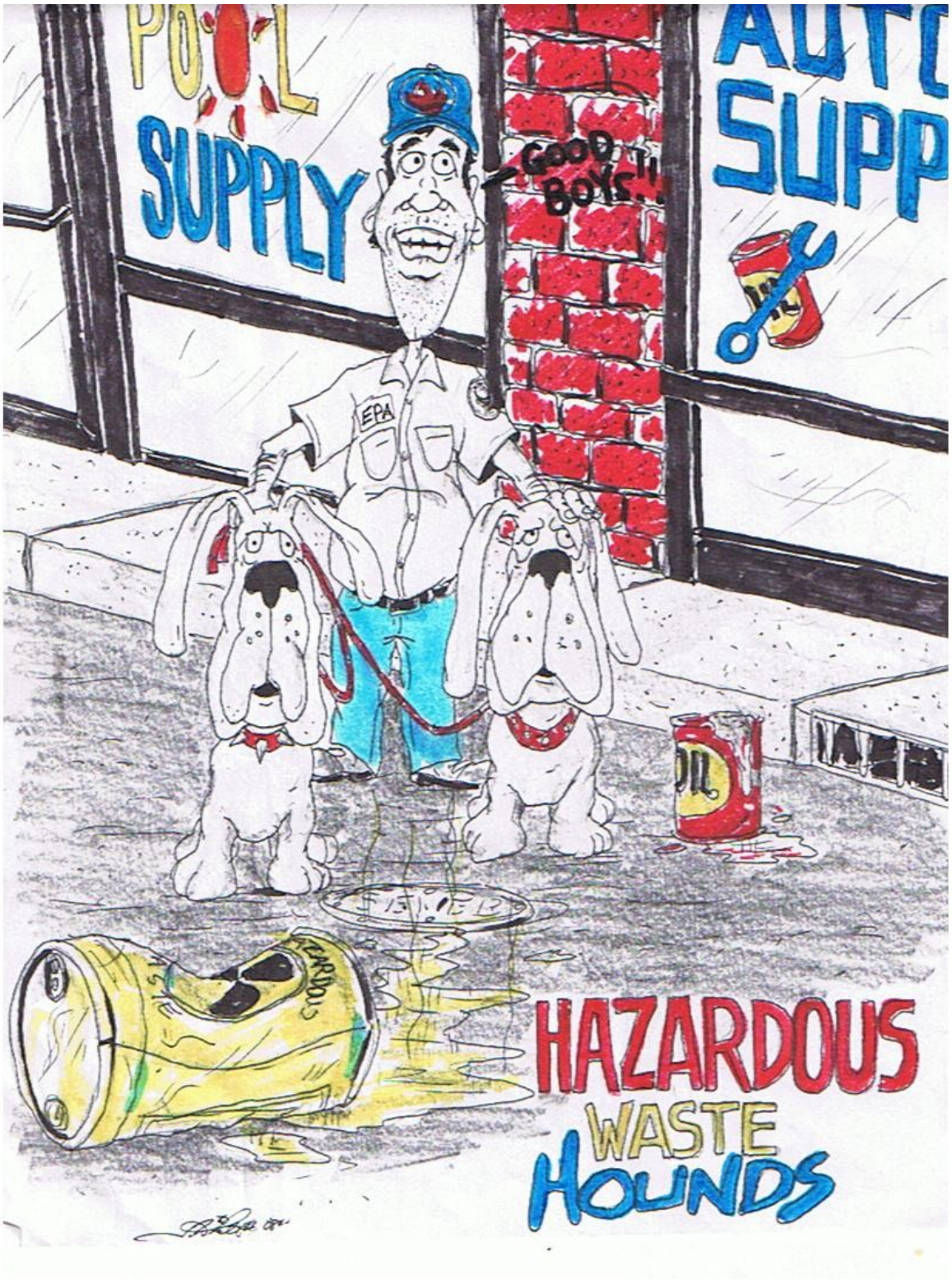
threshold limit value (TLV): the quantity of chemical exposure that an individual can tolerate on a daily or routine basis during his or her working life without incurring adverse effects from the exposure.

upper explosive limit (UEL): the upper end of the range at which the gas or vapor level is sufficient to burn or explode if exposed to an ignition source. Above that level the mixture is too rich to burn.



Written Program Example Section

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train employees. OSHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. OSHA compliance officers will be talking to employees to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and SDSs.


POOL
SUPPLY
AUTO
SUPP
GOOD BOYS!
EPA
OIL
HAZARDOUS
WASTE
HOUNDS

Hazard Communication Sample Written Program

29 CFR 1910.1200 and 1926.59
This is a sample written program whose intended usage is to serve only as a convenient guide for obtaining compliance with the applicable OSHA standard. It should be expanded, personalized, and tailored to your companies, places of business, or work sites.

This publication does not itself alter or determine compliance responsibilities, which are set forth in OSHA standards themselves and in the Occupational Safety and Health Act. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

Hazard Communication Program
for <EMPLOYER NAME>

Introduction
A. Statement of Need
There are two primary reasons why <EMPLOYER NAME> will implement a Hazard Communication Program (HCP). One, the employer must comply with the Federal OSHA standard 29 CFR 1910.1200 (general industry) or 29 CFR 1926.59 (construction). Additionally, a HCP will assist the company in achieving our overall goal of a safer work place.

B. Anticipated Benefits
Several benefits are anticipated with the implementation of the Hazard Communication Program.

1. Prevention of chemical related illnesses and injuries.

2. Overall improvement of the company safety program.

3. Improvement of employer-employee relations by establishing regular lines of communications.

4. Avoidance of OSHA citations, violations, and related problems.

C. Program Administrator: <JOB TITLE>

D. Location(s) and contact person(s) for the written program
Location(s): <EACH WORK SITE LOCATION>
Contact person(s): <JOB TITLE>
Telephone number of contact person: <AREA CODE/ NUMBER>

E. Compliance Checklist
A checklist for ensuring compliance with OSHA standards can be found in Appendix D.

F. Warning
Chemicals will not be used until the following requirements are met:

1. All affected employees are properly trained to use the chemicals;
2. A safety data sheet (SDS) is obtained for each chemical;
3. Each chemical is added to the inventory list (Appendix A);
4. Proper personal protective equipment has been selected and issued to affected employees.

Chemicals, which do not meet the four requirements, will be stored at <SITE STORAGE LOCATION> and marked "Do Not Use." Until Hazard Communication and Personal Protective Equipment Requirements are met by Hazard Communication Program Administrator: <JOB TITLE>

I. Purpose
The purpose of the Hazard Communication Program is to ensure that the hazards of chemicals located in the plant are evaluated and that information concerning physical and health hazards is transmitted to potentially exposed employees. It is not only the intent of the employer to fully comply with the OSHA Standard 1910.1200 and 1926.59, but also to improve the overall safety of our company. A successful Hazard Communication Program will reduce potential incidents of chemical source illnesses and injuries.

II. Authority
The Hazard Communication Program is required by the Occupational Safety and Health Administration.

III. Summary
The passage of OSHA's Hazard Communication Standard gives the employer the responsibility to establish a written, comprehensive program which includes provisions for container labeling, material safety data sheets, and employee information and training. The written program must contain a list of the hazardous chemical(s) in each work area, the means used to inform employees of hazards of non-routine tasks, the hazards associated with chemicals contained in unlabeled pipes in their work area, and methods used to inform contractors in the facilities of chemical hazards to which they may be exposed.

The written Hazard Communication Program outlines the plan to establish the objectives of the standard. Each objective will be defined and discussed in this document. Additionally, this written program shall be reviewed during employee training.

The written plan will be reviewed every <PERIOD OF TIME IN MONTHS OR YEARS> for accuracy and completeness.

The written plan and its elements will be updated in the following situations:

1. New chemicals are introduced into the workplace.
2. When new processes involving chemicals are introduced.
3. When program job duties are changed.

4. When locations mentioned in the program are changed.

5. When any other elements are changed.

A record of the last change which includes the date and change will be recorded, and kept with this program by the hazard communication program administrator.

A. Objective 1 - List of chemicals
The <JOB TITLE> is required to maintain and update the list of chemicals purchased or used by this facility. The <JOB TITLE> is required to maintain and update the hazard communication program list of chemicals. The list can be found in Appendix A of this program. Other locations of the list are: <OTHER SITE LOCATIONS, IF APPLICABLE>Procedure for chemical list update:

1. The chemical list employee will have a chemical list on file. New chemical products will be immediately reported to this employee by the purchase or use list employee.

2. As new chemicals are purchased, the chemical list employee will record chemical(s) on the list. Changes in the list will be noted on the hazard communication program list form (Appendix A).

B. Objective 2 - Material Safety Data Sheets (SDS)
Employee in charge of SDS acquisition: <JOB TITLE>
Material Safety Data Sheets are the keystone to a successful hazard communication program. SDS are designed to provide the information needed to handle chemicals safely. They provide the necessary information for training, hazard evaluation, proper handling, emergency procedures, and employee personal protective equipment.

The following procedures will be implemented to ensure that the employer maintains a SDS for all chemicals identified on the hazard communication chemical list and the chemical purchase list.

1. Chemical manufacturers, importers, or distributors supplying the employer with products are required by law to send SDS with the first shipment. As SDS are checked off against the chemical inventory, missing SDS should be requested first by telephone from the manufacturer, importer or distributor of the chemical. A written record of the phone call, including the name of the contact person should be placed in a special file.
   If the telephone request is not successful, a formal letter should be written to request the SDS. A copy should be placed in the special file. A sample form letter can be found in Appendix E.

2. The SDS employee will document all attempts to obtain all SDS.

3. The will require a SDS for <JOB TITLE> each new chemical purchased, as well as updated SDS for existing chemicals. This requirement will be indicated on all purchase orders.

4. If it is not possible to obtain a SDS for a chemical, the following action will need to be taken by the SDS acquisition employee: contact about using a new, <JOB TITLE> or alternate chemical which has an available SDS.

5. SDS for chemicals which are part of an employee exposure record, but no longer used shall be filed by the SDS acquisition employee. An exposure record concerns information when an employee is exposed to a chemical. A more complete definition can be found in 29 CFR 1910. 20 (c)(8) and (10).

   If the SDS was involved with an employee exposure record, the SDS must be handled in one of the following methods:
   1. Kept in an "old SDS" file with a reference to the exposure record; or

   2. Kept with the exposure record with a reference, or copy in the "old SDS" file.

   Old SDS linked to an exposure record must be maintained for at least 30 years. SDS for chemicals no longer used, and not linked to an employee exposure record will be maintained in one of two ways:
   3. Place the old SDS in a special "old SDS" file; or

   4. Make a record of the SDS and maintain it for 30 years (as per 1910.20 (d)(1)(ii)(B) and referenced by 1926.33) with the following information:

      - Identity (chemical name if known)
      - Where used (site and building)
      - When used
      - A glossary of SDS terms will be available in the <(SITE LOCATION)>, and will be a training discussion item.
      - Updated SDSs and new SDSs will be immediately placed in binders in <(SITE LOCATION(S))>

6. The employer will rely on each chemical manufacturer's testing and hazard evaluation of chemical products used throughout the facility. The SDS acquisition and MSD purchase request employees will ensure that SDS are supplied, and that information contained on all SDSs is complete.

C. Objective 3 - Labeling

Hazard Labeling Administrator: <JOB TITLE>

The hazard labeling administrator will ensure proper labeling of primary and secondary containers.

1. Labeling

   The employer will rely heavily on chemical suppliers to provide labeling on the products used in the facilities that meets the requirements of 29 CFR 1910.1200 (f), or 1926.59(f). There are three basic requirements of this section:

   1. Identity of the chemical
   2. Appropriate hazard warning - including target organs
   3. Name and address of the chemical manufacturer

2. Shipped and purchased containers

   With the arrival of each chemical the <JOB TITLE> will check all containers to ensure that all labels meet the requirements outlined in this program. The employer will not accept improperly labeled containers. If there is a problem with a container, the SDS acquisition and SDS purchase employees should be immediately notified. They will check the program chemical list and the chemical purchase list to ensure that the proper SDSs and labels have been received and updated for the product.

3. Secondary container labeling

   Secondary containers of chemicals should be marked in the following situations:

   1. More than one employee uses the container; or
   2. The container is used longer than one shift, or left in a work area.If one employee uses the chemical without exposing others, and either returns the contents to the original container, or disposes of the rest of it, labeling of the secondary container is not necessary.

   The secondary label should contain the following information, which can be obtained from the original container, or the SDS:

   - Identity of the chemical as specified on the SDS
   - Hazard warning - physical hazard or illness
   - Target organ of the body

   The hazard-labeling administrator will provide secondary container labels, and make sure that they are properly marked. The hazard-labeling administrator will also develop special methods of identification where needed.

D. Objective 4 - Employee training

Employee hazard communication training administrator: <JOB TITLE>

The Hazard Communication Standard requires the employer to provide exposed employees with information and training on the following subjects:

1. Information:
    - Requirements of the standard; and
    - Operations in the work area where hazardous chemicals are present; and
    - Location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by the standard.
2. Training:
    - Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.); and
    - The physical and health hazards of the chemicals in the work area; and
    - The measure employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and
    - The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

    The <JOB TITLE> will provide training to employees in the following situations:
    - Prior to working with a chemical.
    - When job duties change with exposure to new chemicals.
    - When new chemicals are introduced into the workplace.
    - When job duties change which require special training for a special process with a chemical.

    The methods of training are specified in Appendix B of this program. The training records will contain the following information:
    - Date of training
    - Name and job title of trainer

- Names of the trainees
- Training topics
- Any other information to document the validity of the training. Example: credentials of an outside trainer.

The training records form can be found in Appendix C of this written program. The training records can be found in <SITE LOCATION> by contacting the <JOB TITLE> A special publication, "Hazard Communication: A Key to Compliance" can be found in Appendix D of this program. This program explains in detail the intent of the Hazard Communication standard.

E. Objective 5 - Hazard Assessment for Non-Routine Tasks
Hazard Communication non-routine task administrator: <JOB TITLE>
Non-routine tasks are those tasks, which do not occur on a frequent basis, or those tasks, which are not identified as a normal production task. However, many of the tasks required of the maintenance employees will be evaluated on a case-by-case basis to determine if they are to be considered a non-routine task.

The <JOB TITLE> should be consulted about non-routine tasks.

The hazard communication trainer will train employees about the chemical hazards of non-routine tasks.

F. Objective 6 - Work performed by outside contractors

1. The <JOB TITLE> will provide contractors with a list of chemicals used in the work area(s). The contractors will also be provided with copies or the location of the facility SDS.
2. The <JOB TITLE>will find out what chemicals are being brought into the facility by outside contractors. Copies of the SDS, or location of the contractors' SDS will be obtained.

G. Objective 7 - Non-labeled pipes
The <JOB TITLE> will provide special employee education and training for employees who may be involved with work on pipes and piping systems, which carry chemicals.

H. Multi-employer Worksites (construction)

1. At multi-employer worksites the <JOB TITLE> will offer to the site general contractor or site safety director at >PHYSICAL SITE OR ADDRESS< the copies of the following elements of the <EMPLOYER NAME> hazard communication program:
    1. The list of chemicals at the site.
    2. All MSD sheets used at the site.
    3. The physical location of the employer's HCP at the worksite: <ADDRESS OR PHYSICAL LOCATION AND BUILDING OR TRAILER<

4. The name of the employer's Hazard Communication Program Administrator at the worksite: <NAME AND JOB TITLE>

5. The site phone number of the employer's Hazard Communication Program Administrator: <AREA CODE / NUMBER>

2. Exposure to chemicals from other employers at the multi-employer worksite:

   The Hazard <EMPLOYER NAME> Communication Program Administrator at the site will contact the following personnel to obtain information about chemicals other employers are using which affect employees at the site:

   1. Site general contractor Hazard Communication Program Administrator; or

   2. Site Safety Director; or

   3. Hazard Communication Program Administrator(s) of the other employers.

   The Hazard Communication Program Administrator will obtain the following information from the site general contractor, site safety director or other hazard communication program administrator(s):

   4. A list of site chemicals for each employer to which the employees are exposed; and

   5. Copies of MSD sheets for chemicals to which the employees are exposed.

   The MSD sheets and lists should be marked to indicate the employer source. The Hazard Communication Program Administrator will use the information obtained from the other employers to provide additional training, update the site written hazard program for employees, and ensure that other elements of the program are updated for the exposed employees.

Sample Hazard Communication Training Program

Hazard Communication Training Administrator: <JOB TITLE>

1. The employer falls into an industrial or construction category where OSHA regulations require four basic needs for hazard communication:

   1. A written hazard communication program.

   2. Material safety data sheets on each chemical.

   3. Label all chemical containers.

   4. Train employees about hazards of the chemicals they use.

2. Some employees work with or near hazardous chemicals, and the company wants those employees to be aware of this and the protective equipment use which may include face shields, glasses, splash goggles, respirators, gloves, rubber boots, full-body suits, aprons, or maybe only one or two of the above. Then in case of accident, the company wants the employees to know what to do to protect themselves from these hazardous chemicals.

Special training and hazard assessment for the use of personal protective equipment will be conducted as specified in 29 CFR 1910.132 through .138.

3. Many of you do not work with hazardous chemicals. Nevertheless, your company wants to advise you about chemicals used by the company. Also, this information may be helpful in the use of chemicals in your homes, and in your yards and gardens. There are many hazardous chemicals used in the home.

4. Part of our program relates to what we call MSD sheets. SDS stands for Material Safety Data Sheets. If you aren't a chemist, there will be much on this data sheet that you won't understand. We're not chemists and some of this data is new to us. There are parts we do understand, and those parts deal with how we use the chemicals and the personal protective equipment in case of an accident. Therefore, discussing how to read an MSD sheet is a vital part of this program.

5. You may breath chemicals into your lungs. Chemicals can also enter through the skin, nose, mouth, eyes, and elsewhere.

6. Chemicals may affect your lungs, heart, skin, kidneys, brain, nervous system, liver, eyes, and other parts of your body.

7. If you work with chemicals, learn or post emergency procedures, emergency telephone numbers, and how to read labels. If you transfer to another work location with new chemicals, learn how to safely use those chemicals.

   If new chemicals are brought into your work place, learn the hazards of these and how to safely handle them, what protective equipment to use and what to do in case of an emergency. If you encounter a new chemical that you are not familiar with, contact your supervisor about proper training before using the chemical.

8. Each of you have presented with a MSD sheet. We will discuss the information on this sheet. (Complete discussion on all data on the MSD sheets)

9. Will discuss the location in the <JOB TITLE< facility where hazardous chemicals are used and the proper and safe work procedures for these chemicals. The proper use of personal protection equipment will be discussed. Also, in case of an accident, you will be advised about safety precautions to be taken to protect yourself from serious injury.

10. Will also advise you on the <JOB TITLE< location in the facility where the MSD sheets are kept, along with the company written program for hazardous chemicals. You are entitled to look at this data at any time should you wish to know about the chemicals in your work place. Let me suggest that you contact your supervisor in these cases to see these records.

11. Will also advise you about how <JOB TITLE< the company is labeling these materials, and how to detect hazards by visibility and odors.

12. Generally speaking:

1. Know if you are working with hazardous materials.
2. Know how to recognize them by sight, by labels, by odors, etc.
3. Know how to use the chemicals safely.
4. Know what to do in case of a chemically related accident.

Appendix A: List of Chemicals (or Chemical Inventory)
Note: the chemical name should be identical to that found on the MSD sheet.

Chemical Name

<list of chemicals here>

Appendix B: Specific Methods of Training

Date of Training	Name and Job Title of Trainer	Names of Trainees	Training Topics	Training Method	Other Information
01/01/01	Example		MSD sheets	video titled "MSD Sheets"	

Appendix C: Training Record

Trainer(s): Date Employee Name Job Title

Appendix D: Guidelines for Employer Compliance

The Hazard Communication Standard (HCS) is based on a simple concept--that employees have both a need and a right to know the hazards and identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring. The HCS is designed to provide employees with the information they need.

Knowledge acquired under the HCS will help employers provide safer workplaces for their employees. When employers have information about the chemicals being used, they can take steps to reduce exposures, substitute less hazardous materials, and establish proper work practices. These efforts will help prevent the occurrence of work-related illnesses and injuries caused by chemicals.

The HCS addresses the issues of evaluating and communicating hazards to workers. Evaluation of chemical hazards involves a number of technical concepts, and is a process that requires the professional judgment of experienced experts. That's why the HCS is designed so that employers who simply use chemicals, rather than produce or import them, are not required to evaluate the hazards of those chemicals. Hazard determination is the responsibility of the producers and importers of the materials. Producers and importers of chemicals are then required to provide the hazard information to employers that purchase their products.

Employers that don't produce or import chemicals need only focus on those parts of the rule that deal with establishing a workplace program and communicating information to their workers. This appendix is a general guide for such employers to help them determine what's required under the rule. It does not supplant or substitute for the regulatory provisions, but rather provides a simplified outline of the steps an average employer would follow to meet those requirements.

1. **Becoming familiar with the rule.**
   OSHA has provided a simple summary of the HCS in a pamphlet entitled "Chemical Hazard Communication," OSHA Publication Number 3084. Some employers prefer to begin to become familiar with the rule's requirements by reading this pamphlet. A copy may be obtained from your local OSHA Area Office, or by contacting the OSHA Publications Office .

   The standard is long, and some parts of it are technical, but the basic concepts are simple. In fact, the requirements reflect what many employers have been doing for years. You may find that you are already largely in compliance with many of the provisions, and will simply have to modify your existing programs somewhat. If you are operating in an OSHA-approved State Plan State, you must comply with the State's requirements, which may be different than those of the Federal rule. Many of the State Plan States had hazard communication or "right-to-know" laws prior to promulgation of the Federal rule. Employers in State Plan States should contact their State OSHA offices for more information regarding applicable requirements.

   The HCS requires information to be prepared and transmitted regarding all hazardous chemicals. The HCS covers both physical hazards (such as flammability), and health hazards (such as irritation, lung damage, and cancer). Most chemicals used in the workplace have some hazard potential, and thus will be covered by the rule.
   One difference between this rule and many others adopted by OSHA is that this one is performance-oriented. That means that you have the flexibility to adapt the rule to the needs of your workplace, rather than having to follow specific, rigid requirements. It also means that you have to exercise more judgment to implement an appropriate and effective program.

   The standard's design is simple. Chemical manufacturers and importers must evaluate the hazards of the chemicals they produce or import. Using that information, they must then prepare labels for containers, and more detailed technical bulletins called material safety data sheets (SDS).

   Chemical manufacturers, importers, and distributors of hazardous chemicals are all required to provide the appropriate labels and material safety data sheets to the employers to which they ship the chemicals. The information is to be provided automatically. Every container of hazardous chemicals you receive must be labeled, tagged, or marked with the required information. Your suppliers must also send you a properly completed Safety Data Sheet(SDS) at the time of the first shipment of the chemical, and with the next shipment after the SDS is updated with new and significant information about the hazards.

You can rely on the information received from your suppliers. You have no independent duty to analyze the chemical or evaluate the hazards of it.

Employers that "use" hazardous chemicals must have a program to ensure the information is provided to exposed employees. "Use" means to package, handle, react, or transfer. This is an intentionally broad scope, and includes any situation where a chemical is present in such a way that employees may be exposed under normal conditions of use or in a foreseeable emergency.

The requirements of the rule that deal specifically with the hazard communication program are found in the standard in paragraphs (e), written hazard communication program; (f), labels and other forms of warning; (g), material safety data sheets; and (h), employee information and training. The requirements of these paragraphs should be the focus of your attention. Concentrate on becoming familiar with them, using paragraphs (b), scope and application, and (c), definitions, as references when needed to help explain the provisions.

There are two types of work operations where the coverage of the rule is limited. These are laboratories and operations where chemicals are only handled in sealed containers (e.g., a warehouse). The limited provisions for these workplaces can be found in paragraph (b), scope and application. Basically, employers having these types of work operations need only keep labels on containers as they are received; maintain material safety data sheets that are received, and give employees access to them; and provide information and training for employees. Employers do not have to have written hazard communication programs and lists of chemicals for these types of operations.

The limited coverage of laboratories and sealed container operations addresses the obligation of an employer to the workers in the operations involved, and does not affect the employer's duties as a distributor of chemicals. For example, a distributor may have warehouse operations where employees would be protected under the limited sealed container provisions.

In this situation, requirements for obtaining and maintaining SDSs are limited to providing access to those received with containers while the substance is in the workplace, and requesting SDSs when employees request access for those not received with the containers. However, as a distributor of hazardous chemicals, that employer will still have responsibilities for providing SDSs to downstream customers at the time of the first shipment and when the SDS is updated. Therefore, although they may not be required for the employees in the work operation, the distributor may, nevertheless, have to have SDSs to satisfy other requirements of the rule.

2. **Identifying responsible staff.**
   Hazard communication is going to be a continuing program in your facility. Compliance with the HCS is not a "one shot deal." In order to have a successful program, it will be necessary to assign responsibility for both the initial and ongoing activities that have to be undertaken to comply with the rule. In some cases, these activities may already be part of current job assignments.

   For example, site supervisors are frequently responsible for on-the-job training sessions. Early identification of the responsible employees, and involvement of them in the development of your plan of action, will result in a more effective program design. Evaluation of the effectiveness of your program will also be enhanced by involvement of affected employees. For any safety and health program, success depends on commitment at every level of the organization. This is particularly true for hazard communication, where success requires a change in behavior. This will only occur if employers understand the program, and are committed to its success, and if employees are motivated by the people presenting the information to them.

3. **Identifying hazardous chemicals in the workplace.**
   The standard requires a list of hazardous chemicals in the workplace as part of the written hazard communication program. The list will eventually serve as an inventory of everything for which an SDS must be maintained. At this point, however, preparing the list will help you complete the rest of the program since it will give you some idea of the scope of the program required for compliance in your facility. The best way to prepare a comprehensive list is to survey the workplace. Purchasing records may also help, and certainly employers should establish procedures to ensure that in the future purchasing procedures result in SDSs being received before a material is used in the workplace.

   The broadest possible perspective should be taken when doing the survey. Sometimes people think of "chemicals" as being only liquids in containers. The HCS covers chemicals in all physical forms--liquids, solids, gases, vapors, fumes, and mists--whether they are "contained" or not. The hazardous nature of the chemical and the potential for exposure are the factors, which determine whether a chemical is covered. If it's not hazardous, it's not covered. If there is no potential for exposure (e.g., the chemical is inextricably bound and cannot be released), the rule does not cover the chemical.

   Look around. Identify chemicals in containers, including pipes, but also think about chemicals generated in the work operations. For example, welding fumes, dusts, and exhaust fumes are all sources of chemical exposures. Read labels provided by suppliers for hazard information. Make a list of all chemicals in the workplace that are potentially hazardous. For your own information and planning, you may also want to note on the list the location(s) of the products within the workplace, and an indication of the hazards as found on the label. This will help you as you prepare the rest of your program.

Paragraph (b), scope and application, includes exemptions for various chemicals or workplace situations. After compiling the complete list of chemicals, you should review paragraph (b) to determine if any of the items can be eliminated from the list because they are exempted materials. For example, food, drugs, and cosmetics brought into the workplace for employee consumption are exempt. So rubbing alcohol in the first aid kit would not be covered. Once you have compiled as complete a list as possible of the potentially hazardous chemicals in the workplace, the next step is to determine if you have received material safety data sheets for all of them. Check your files against the inventory you have just compiled. If any are missing, contact your supplier and request one. It is a good idea to document these requests, either by copy of a letter or a note regarding telephone conversations. If you have SDSs for chemicals that are not on your list, figure out why. Maybe you don't use the chemical anymore. Or maybe you missed it in your survey. Some suppliers do provide SDSs for products that are not hazardous. These do not have to be maintained by you. You should not allow employees to use any chemicals for which you have not received an SDS. The SDS provides information you need to ensure proper protective measures are implemented *prior* to exposure.

4. **Preparing and implementing a hazard communication program.**
All workplaces where employees are exposed to hazardous chemicals must have a written plan, which describes how the standard will be implemented in that facility. Preparation of a plan is not just a paper exercise--all of the elements must be implemented in the workplace in order to be in compliance with the rule. See paragraph (e) of the standard for the specific requirements regarding written hazard communication programs. The only work operations which do not have to comply with the written plan requirements are laboratories and work operations where employees only handle chemicals in sealed containers. See paragraph (b), scope and application, for the specific requirements for these two types of workplaces.The plan does not have to be lengthy or complicated. It is intended to be a blueprint for implementation of your program--an assurance that all aspects of the requirements have been addressed. Many trade associations and other professional groups have provided sample programs and other assistance materials to affected employers. These have been very helpful to many employers since they tend to be tailored to the particular industry involved. You may wish to investigate whether your industry trade groups have developed such materials.

   Although such general guidance may be helpful, you must remember that the written program has to reflect what you are doing in your workplace. Therefore, if you use a generic program it must be adapted to address the facility it covers. For example, the written plan must list the chemicals present at the site, indicate who is to be responsible for the various aspects of the program in your facility, and indicate where written materials will be made available to employees. If OSHA inspects your workplace for compliance with the HCS, the OSHA compliance officer will ask to see your written plan at the outset of the inspection.

In general, the following items will be considered in evaluating your program. The written program must describe how the requirements for labels and other forms of warning, material safety data sheets, and employee information and training, are going to be met in your facility. The following discussion provides the type of information compliance officers will be looking for to decide whether these elements of the hazard communication program have been properly addressed:

1. **Labels and other forms of warning.**
   In-plant containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings. Chemical manufacturers, importers, and distributors are required to ensure that every container of hazardous chemicals they ship is appropriately labeled with such information and with the name and address of the producer or other responsible party. Employers purchasing chemicals can rely on the labels provided by their suppliers. If the employer subsequently transfers the material from a labeled container to another container, the employer will have to label that container unless it is subject to the portable container exemption. See paragraph (f) for specific labeling requirements. The primary information to be obtained from an OSHA-required label is an identity for the material, and appropriate hazard warnings. The identity is any term, which appears on the label, the SDS, and the list of chemicals, and thus links these three sources of information. The identity used by the supplier may be a common or trade name ("Black Magic Formula"), or a chemical name (1,1,1,-trichloroethane). The hazard warning is a brief statement of the hazardous effects of the chemical ("flammable," "causes lung damage"). Labels frequently contain other information, such as precautionary measures ("do not use near open flame"), but this information is provided voluntarily and is not required by the rule. Labels must be legible, and prominently displayed. There are no specific requirements for size or color, or any specified text. With these requirements in mind, the compliance officer will be looking for the following types of information to ensure that labeling will be properly implemented in your facility:
   1. Designation of person(s) responsible for ensuring labeling of in-plant containers;
   2. Designation of person(s) responsible for ensuring labeling of any shipped containers;
   3. Description of labeling system(s) used;
   4. Description of written alternatives to labeling of in-plant containers (if used); and,
   5. Procedures to review and update label information when necessary.

   Employers that are purchasing and using hazardous chemicals--rather than producing or distributing them--will primarily be concerned with ensuring that every purchased container is labeled. If materials are transferred into other containers, the employer must ensure that these are labeled as well, unless they fall under the portable container exemption [paragraph (f)(7)]. In terms of labeling systems, you can simply choose to use the labels provided by

your suppliers on the containers. These will generally be verbal text labels, and do not usually include numerical rating systems or symbols that require special training. The most important thing to remember is that this is a continuing duty--all in-plant containers of hazardous chemicals must always be labeled. Therefore, it is important to designate someone to be responsible for ensuring that the labels are maintained as required on the containers in your facility, and that newly purchased materials are checked for labels prior to use.

2. **Material safety data sheets.**
Chemical manufacturers and importers are required to obtain or develop a Safety Data Sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these SDSs. Employers must have an SDS for each hazardous chemical, which they use. Employers may rely on the information received from their suppliers. The specific requirements for material safety data sheets are in paragraph (g) of the standard.

There is no specified format for the SDS under the rule, although there are specific information requirements. OSHA has developed a non-mandatory format, OSHA Form 174, which may be used by chemical manufacturers and importers to comply with the rule. The SDS must be in English. You are entitled to receive from your supplier a data sheet that includes all of the information required under the rule. If you do not receive one automatically, you should request one. If you receive one that is obviously inadequate, with, for example, blank spaces that are not completed, you should request an appropriately completed one. If your request for a data sheet or for a corrected data sheet does not produce the information needed, you should contact your local OSHA Area Office for assistance in obtaining the SDS. The role of SDSs under the rule is to provide detailed information on each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures. This information should be useful to you as the employer responsible for designing protective programs, as well as to the workers. If you are not familiar with material safety data sheets and with chemical terminology, you may need to learn to use them yourself. A glossary of SDS terms may be helpful in this regard. Generally speaking, most employers using hazardous chemicals will primarily be concerned with SDS information regarding hazardous effects and recommended protective measures. Focus on the sections of the SDS that are applicable to your situation. SDSs must be readily accessible to employees when they are in their work areas during their work shifts.

This may be accomplished in many different ways. You must decide what is appropriate for your particular workplace. Some employers keep the SDSs in a binder in a central location (e.g., in the pick-up truck on a construction site). Others, particularly in workplaces with large numbers of chemicals, computerize the information and provide access through terminals. As long as employees can get the information when they need it, any approach may be used. The employees must have access to the SDSs themselves--simply having a system where the information can be read to them over the phone

is only permitted under the mobile worksite provision, paragraph (g)(9), when employees must travel between workplaces during the shift.

In this situation, they have access to the SDSs prior to leaving the primary worksite, and when they return, so the telephone system is simply an emergency arrangement. In order to ensure that you have a current SDS for each chemical in the plant as required, and that employee access is provided, the compliance officers will be looking for the following types of information in your written program:

1. Designation of person(s) responsible for obtaining and maintaining the SDSs;

2. How such sheets are to be maintained in the workplace (e.g., in notebooks in the work area(s) or in a computer with terminal access), and how employees can obtain access to them when they are in their work area during the work shift;

3. Procedures to follow when the SDS is not received at the time of the first shipment;

4. For producers, procedures to update the SDS when new and significant health information is found; and,

5. Description of alternatives to actual data sheets in the workplace, if used.

For employers using hazardous chemicals, the most important aspect of the written program in terms of SDSs is to ensure that someone is responsible for obtaining and maintaining the SDSs for every hazardous chemical in the workplace. The list of hazardous chemicals required to be maintained as part of the written program will serve as an inventory. As new chemicals are purchased, the list should be updated. Many companies have found it convenient to include on their purchase orders the name and address of the person designated in their company to receive SDSs.

3. **Employee information and training.**

Each employee who may be "exposed" to hazardous chemicals when working must be provided information and trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes. "Exposure" or "exposed" under the rule means "an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.) and includes potential (e.g., accidental or possible) exposure." See paragraph (h) of the standard for specific requirements. Information and training may be done either by individual chemical, or by categories of hazards (such as flammability or carcinogenicity). If there are only a few chemicals in the workplace, then you may want to discuss each one individually. Where there are large numbers of chemicals, or the chemicals change frequently, you will probably want to train generally based on the hazard categories (e.g., flammable liquids, corrosive materials, carcinogens).

Employees will have access to the substance-specific information on the labels and SDSs. Information and training is a critical part of the hazard communication program. Information regarding hazards and protective measures are provided to workers through written labels and material safety data sheets. However, through effective information and training, workers will learn to read and understand such information, determine how it can be obtained and used in their own workplaces, and understand the risks of exposure to the chemicals in their workplaces as well as the ways to protect themselves. A properly conducted training program will ensure comprehension and understanding. It is not sufficient to either just read material to the workers, or simply hand them material to read. You want to create a climate where workers feel free to ask questions. This will help you to ensure that the information is understood.

You must always remember that the underlying purpose of the HCS is to reduce the incidence of chemical source illnesses and injuries. This will be accomplished by modifying behavior through the provision of hazard information and information about protective measures. If your program works, you and your workers will better understand the chemical hazards within the workplace. The procedures you establish regarding, for example, purchasing, storage, and handling of these chemicals will improve, and thereby reduce the risks posed to employees exposed to the chemical hazards involved.

Furthermore, your workers' comprehension will also be increased, and proper work practices will be followed in your workplace. If you are going to do the training yourself, you will have to understand the material and be prepared to motivate the workers to learn. This is not always an easy task, but the benefits are worth the effort. More information regarding appropriate training can be found in OSHA Publication No. 2254 which contains voluntary training guidelines prepared by OSHA's Office of Training and Education.

A copy of this document is available from OSHA's Publications Office at (202) 693-1888. In reviewing your written program with regard to information and training, the following items need to be considered:

1. Designation of person(s) responsible for conducting training;

2. Format of the program to be used (audiovisuals, classroom instruction, etc.);

3. Elements of the training program (should be consistent with the elements in paragraph (h) of the HCS); and,

4. Procedure to train new employees at the time of their initial assignment to work with a hazardous chemical, and to train employees when a new hazard is introduced into the workplace.

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train employees. OSHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. OSHA compliance officers will be talking to employees to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and SDSs.

The rule does not require employers to maintain records of employee training, but many employers choose to do so. This may help you monitor your own program to ensure that all employees are appropriately trained. If you already have a training program, you may simply have to supplement it with whatever additional information is required under the HCS. For example, construction employers that are already in compliance with the construction training standard (29 CFR 1926.21) will have little extra training to do.

An employer can provide employees information and training through whatever means found appropriate and protective. Although there would always have to be some training on-site (such as informing employees of the location and availability of the written program and SDSs), employee training may be satisfied in part by general training about the requirements of the HCS and about chemical hazards on the job which is provided by, for example, trade associations, unions, colleges, and professional schools. In addition, previous training, education and experience of a worker may relieve the employer of some of the burdens of informing and training that worker. Regardless of the method relied upon, however, the employer is always ultimately responsible for ensuring that employees are adequately trained. If the compliance officer finds that the training is deficient, the employer will be

cited for the deficiency regardless of who actually provided the training on behalf of the employer.

4. **Other requirements.**
   In addition to these specific items, compliance officers will also be asking the following questions in assessing the adequacy of the program:

   1. Does a list of the hazardous chemicals exist in each work area or at a central location?

   2. Are methods the employer will use to inform employees of the hazards of non-routine tasks outlined?

   3. Are employees informed of the hazards associated with chemicals contained in unlabeled pipes in their work areas?

   4. On multi-employer worksites, has the employer provided other employers with information about labeling systems and precautionary measures where the other employers have employees exposed to the initial employer's chemicals?

   5. Is the written program made available to employees and their designated representatives?

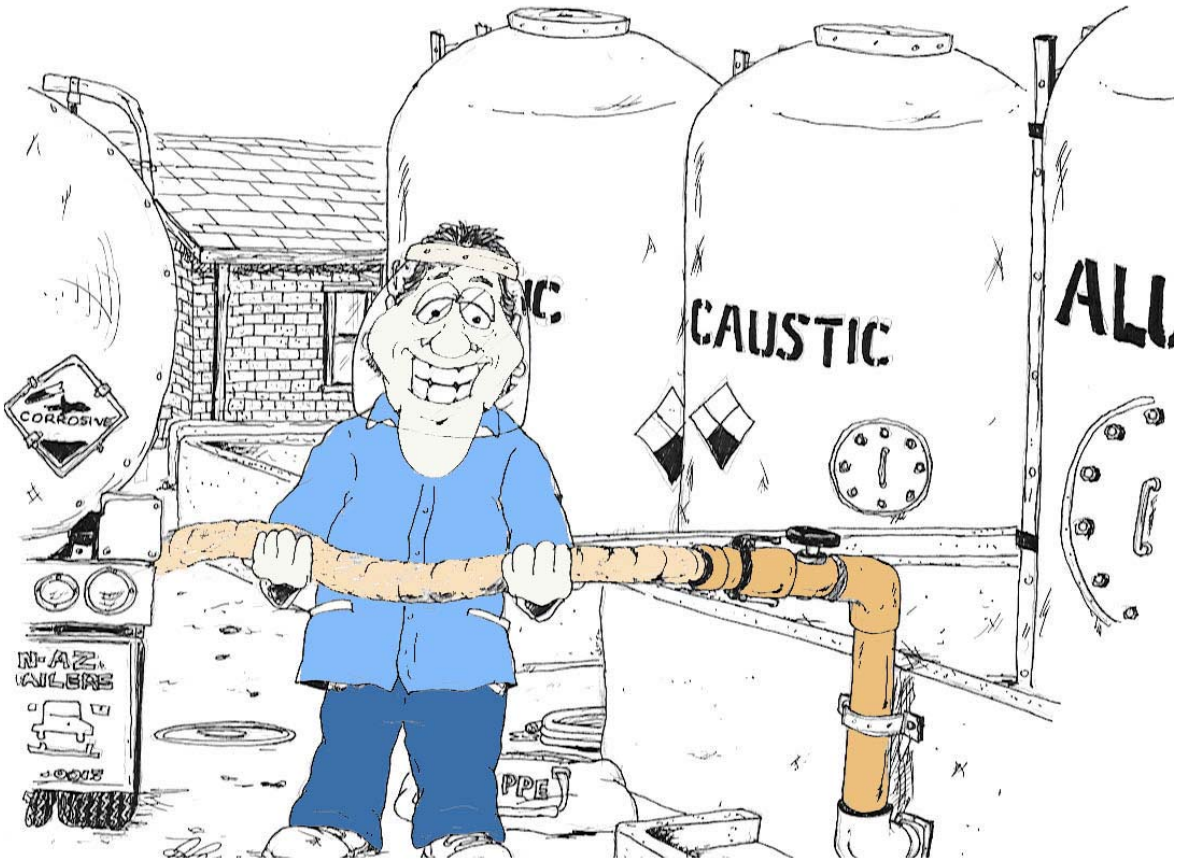
5. **Checklist for compliance.**

   The following checklist will help to ensure you are in compliance with the rule:
   - Obtain a copy of the rule.
   - Read and understood the requirements.
   - Assigned responsibility for tasks.
   - Prepared an inventory of chemicals.
   - Ensured containers are labeled.
   - Obtained SDS for each chemical.
   - Prepared written program.
   - Made SDSs available to workers.
   - Conducted training of workers.
   - Established procedures to maintain current program.
   - Established procedures to evaluate effectiveness.

Appendix E: Form Letter for Obtaining a SDS Sheet
<DATE>
<NAME> and <ADDRESS> of SDS supplier (manufacturer, importer or distributor)

Mr. or Ms.:
My company recently purchased your product <PRODUCT IDENTIFIER> and a Safety Data Sheet (SDS sheet) did not arrive with the first delivery.
Please send me an appropriate SDS sheet which will meet the requirements set forth in the OSHA standards.

Thank you for your cooperation.
Sincerely,
<EMPLOYEE NAME>



Understanding Chemical Basics

An introduction to chemical basics makes it easier for employees to identify potential hazards and take steps to protect themselves.

The SDS gives information on a chemical's characteristics as well as conditions that will change it and its hazards, including:

- ✓ **Normal appearance and odor**—so you can notice anything different and possibly dangerous.
- ✓ **Physical state**—chemicals may be in a gas, liquid, or solid state.
- ✓ **Boiling, freezing, or melting point**—the temperature at which a physical change can take place-from a liquid to a gas, a liquid to a solid, or a solid to a liquid. These changes can be dangerous, even explosive.
- ✓ **Solubility in water**—how much of a chemical will dissolve in water.
- ✓ **Specific gravity or density**—compares the density, or weight, of the chemical to the density of water, which has a relative value of 1; chemicals with a density below 1 will float on top of the water, and chemicals with a density above 1 will sink.
- ✓ **Vapor pressure and evaporation rate**—the higher the pressure, the faster the chemical will evaporate and put vapors into the air; this is especially important for flammable or toxic gases and vapors.
- ✓ **Vapor density**—compares the density of the chemical's vapor to the density of air, which has a relative density of 1; chemicals with a vapor density below 1 will rise into the air, and chemicals with a vapor density above 1 will sink.

Fire, Explosion, and Reactivity Hazards

Some chemicals present physical hazards such as the potential for fire, explosion, and reactivity. The MSDS explains these physical hazards.

- ✓ **Flammable chemicals**—catch fire easily. The MSDS will tell if it's flammable.
- ✓ **Flash point**—the minimum temperature at which a liquid gives off enough vapors to burn. The lower the flash point, the more flammable the substance.
- ✓ **Flammable limits**—the range of concentration of a substance in the air within which a substance can readily catch fire. Concentrations below or above the limits are less likely to ignite or burn.
- ✓ **LEL and UEL**—lower and upper explosive limits are the minimum and maximum concentrations of the chemical's vapor in the air that will explode if exposed to an ignition source.

Firefighting measures may also be found, including:

- ✓ What to use to put out the fire (foam, CO2, etc.)
- ✓ Special hazards, such as toxic vapors
- ✓ Protective gear for fire fighting

Reactivity

Chemicals may react when mixed with other chemicals or when exposed to heat, water, or even air. They can burn, give off toxic vapors, or expand rapidly and release pressure in an explosion.

The SDS alerts workers to these hazards by telling them about the chemical's:

Stability/instability—how well a chemical resists change and conditions that create instability such as heat, shock, pressure, etc.

- ✓ Incompatibility—what the chemical will react dangerously with; therefore, what chemicals and materials should be kept apart.
- ✓ Hazardous decomposition or by-products—whether the chemical will create new hazards or hazardous products as it breaks down or reacts.
- ✓ Hazardous polymerization—the ability of a substance to react with itself, releasing heat that can lead to an explosion.

Health Hazards Identified

Working with hazardous chemicals presents the risk of exposure to substances that can affect your health. The SDS identifies the hazards to your health, including:

- ✓ **Symptoms of exposure**—the SDS can describe the symptoms of exposure to look for, such as headache, nausea, dizziness, rashes, or dermatitis. You may also find information about how the chemical may make existing medical conditions, such as high blood pressure and asthma, worse and how specific organs may be affected.
- ✓ **Exposure routes**—the SDS can tell you how the chemical can enter the body: through contact with eyes or skin, by inhaling a vapor, or by swallowing (often by contact with food or smoking).
- ✓ **Health effects**—the SDS may tell you whether the chemical can cause acute or chronic health effects. Acute health effects, such as burns and eye irritation, show up right after exposure. Chronic effects, such as cancer or some skin conditions, can result from past exposure or repeated exposure over time. The SDS will inform you of whether the chemical is a carcinogen.

Exposure Control Measures

Steps to control exposure may also be listed, such as:

- ✓ Ventilation requirements.
- ✓ Hygiene practices-such as showering and washing work clothes at work.
- ✓ Examples of safe handling, storage, and use, such as "**Keep drum closed when not in use**" and "**Store in a cool, dry place**."

Personal protective equipment (**PPE**) and clothing prevents employees from contacting hazardous substances. The SDS will list the necessary PPE for eye and face protection, respiratory protection, or skin protection. Check with a supervisor about PPE selection, use, or care. (***Refer to training sessions on PPE: Eye and Face, PPE: Respirator Use, and PPE: Protective Clothing.)***

Hazardous Consumer Products

These include cleaning products and pesticides. Their labels will be somewhat different because these products are regulated by the Consumer Product Safety Commission or the Environmental Protection Agency, not OSHA. The same basic warning information is provided but usually in greater detail.

Treat these products the same as other chemicals: Read the label before starting any job. Check the products you use at home, too.

Summary

- ✓ Check all incoming containers to be sure they have complete labels. Report any problems.
- ✓ Check all containers before handling or using them to see if they have legible labels with all the required information. Report any problems.
- ✓ Never handle or use the contents of a container that has no label—or an incomplete or illegible one.
- ✓ If you can't understand some information on a label, ask your supervisor.
- ✓ If there's not enough information on a label to determine how to store or use the chemical or what protective clothing to wear, check the MSDS.
- ✓ Follow label warnings and instructions. They're a key part of every worker's right to know about hazards on the job and how to protect against those risks.

Exposure Limits

Information on the chemical's exposure limits—how much of the chemical it is believed you can safely be exposed to over time--may be given as:

PEL—Permissible Exposure Limit set by OSHA. To explain it simply, it's the averaged maximum concentration of the chemical in the air to which OSHA believes a person can be exposed repeatedly without developing health problems. The PEL is generally expressed in parts per million (**ppm**). Concentrations at or above the PEL make respiratory protection mandatory.

TLV—Threshold Limit Value, recommended by the American Conference of Governmental Industrial Hygienists. To explain it simply, it's the average maximum air concentration of the chemical that a worker may be repeatedly exposed to without adverse effect. Unlike the PEL, this is a recommendation rather than a mandatory limit. The MSDS may also provide other exposure limits used or recommended by the chemical manufacturer or importer.

Laboratory Use of Hazardous Chemicals Section

Always utilize a fume hood when using dangerous or toxic chemicals.

BIOHAZARDOUS INFECTIOUS MATERIAL: Under the Canadian Controlled Products Regulations, a biohazardous infectious material is a material that contains organisms which can cause disease in humans or animals. For example, a person exposed to a blood sample from someone with hepatitis B may contract the disease. Some jurisdictions require SDSs for products which contain biohazardous infectious materials.

Laboratory Use of Hazardous Chemicals Requirements

Applicability
Regulation: **29 CFR 1910.1450**
This training applies to all employers engaged in the laboratory use of hazardous chemicals. Affected employees are those employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of their assignments. Other individuals who would benefit from such training include all individuals at risk.

Emergency and Personal Protection Training

- ✓ Every laboratory worker should know the location and proper use of available protective apparel and equipment.
- ✓ Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures.
- ✓ Such training as well as first-aid instruction should be available to and encouraged for everyone who might need it.
- ✓ Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations.
- ✓ OSHA urges employers to make training and education programs a regular, continuing activity-not simply an annual presentation.

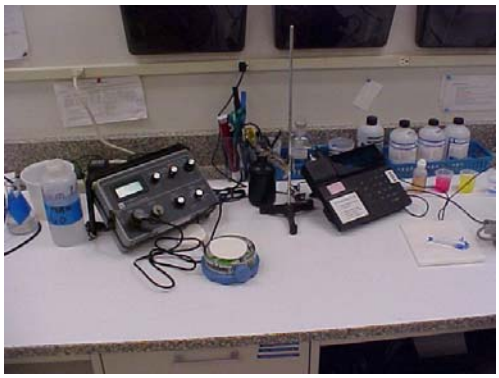
Chemical Hygiene Plan
Hazardous chemicals are always a potential safety problem, but they are a particular concern for employees who work in laboratories that may have a wide variety of chemicals present. For this reason, OSHA established a separate standard for exposure to hazardous chemicals in laboratories that requires employers with laboratories to have a written Chemical Hygiene Plan (**CHP**).

The details of the plan may vary depending on the laboratory, but basic information and training must include detection of hazards and methods of protecting against these hazards.

OSHA requires that laboratory employees be informed of:
- ✓ The contents of this standard.
- ✓ The location and availability of the employer's CHP.
- ✓ The permissible exposure limits for OSHA-regulated substances or recommended exposure limits for other hazardous chemicals.
- ✓ Signs and symptoms associated with exposure to hazardous chemicals used in the laboratory.
- ✓ The location and availability of known reference materials.

OSHA also requires that laboratory employees be trained in

- ✓ Methods used to detect the presence or release of hazardous chemicals.
- ✓ Physical and health hazards of chemicals in the laboratory work area.
- ✓ Measures employees can use to protect themselves, including safe work practices, emergency procedures, and personal protective equipment (**PPE**).
- ✓ The details of the employer's CHP.



Questions

1. Name some potential hazards associated with laboratory chemicals.

2. What are the leading causes of exposure to hazards in laboratories

3. What is your company's Chemical Hygiene Plan?

Controlling Chemical Exposures

The basic routes for a chemical to enter the body in a laboratory setting are: inhalation, skin and eye contact, ingestion, and injection. The prevention of entry by one of these routes can be accomplished by control mechanisms such as engineering controls, personal protective equipment, and administrative controls. Each route can be minimized by a variety of control measures depending on the hazard and operation.

Employing administrative controls is the most desirable method for controlling chemicals exposures and must be used whenever plausible. Administrative controls include but are not limited to:

- ✓ Hazard information and education.
- ✓ Substitution of a non-hazardous or less hazardous chemical, procedure, or equipment.
- ✓ Reducing the volumes of experiments or quantities used.
- ✓ Control and minimize individual exposure times. Rotate responsibilities.
- ✓ Restrict access to an area where a hazardous chemical is in use.
- ✓ Conduct operations that produce nuisance odors outside of typical hours.
- ✓ Place proper signs on doors to indicate the hazards within and the name and phone numbers of appropriate individuals to contact in an emergency.

Inhalation
Inhalation of hazardous chemicals is the most common route of entry to the body in laboratory operations. The American Conference of Governmental Industrial Hygienists (**ACGIH**) produces annual lists of Threshold Limit Values (**TLVs**) and Short Term Exposure Limits (**STELs**) for common chemicals and biological agents used in the laboratory. These values are guides, not legal standards, and are defined as follows:

- **TLV**: Time-weighted average concentration for a normal 8-hour workday to which nearly all workers may be repeatedly exposed without adverse effect.
- **STEL**: Maximum concentration to which workers can be exposed for periods of up to 15 minutes. Such exposures should be limited to no more than 4 per day with at least 60 minutes between exposures; and the total time-weighted average should not exceed the TLV value.

Most of the 1968 TLVs were adopted by OSHA as Permissible Exposure Levels (**PELs**). To avoid significant inhalation exposures and to limit exposure to concentrations below PEL values, there are a number of control measures that can be used. Substituting a less toxic or less volatile chemical is the most desirable measure. If substitution is not practical, ventilation will be used to reduce exposure. Dilution ventilation may be used to reduce exposure to nonhazardous nuisance vapor and odor. All hazardous chemicals should be used in a properly functioning chemical fume hood.

For extremely toxic substances, such as those classified as poison inhalation hazards by the Department of Transportation, the use of closed systems such as a glove box may be required. If necessary, personal protective equipment will be worn to limit chemical exposures.

OSHA Respirator Standard

Dust masks or half face air purifying respirators may be utilized to this end. Respirators will not be worn in laboratories without first meeting the requirements of the OSHA Respirator Standard (**1910.134**). The requirements include training on proper use, selection, cleaning, and storage of respirators as well as fit testing and medical testing and surveillance to ensure that the user is physically capable of wearing a respirator. See our Respiratory Protection Program for more information.

Skin and Eye Contact
Contact with the skin is a frequent mode of chemical injury. To reduce the risk of chemicals entering the body via skin and eye contact or skin absorption, controls include substitution and ventilation as described above. If this doesn't control the exposure, the next step is the wearing of personal protective equipment such as gloves, eye protection, lab coats, aprons, appropriate shoes, and special protective equipment as required by the specific hazard present.

The laboratory supervisor should consult references to determine the proper protective material for the chemicals being used.

Administrative controls to reduce skin/eye contact exposure include:

- Setting up hazardous and non-hazardous areas in the laboratory.
- Enforcing sound chemical hygiene procedures such as no eating or drinking in the lab and washing hands and face after handling chemicals.

Ingestion
Most of the chemicals used in the laboratory are toxic if they enter the body by ingestion. The relative toxicity of a chemical can be determined by its LD_{50}, which is the quantity of material that in a single dose will cause the death of 50% of the test animals. It is usually expressed in grams or milligrams per kilograms of bodyweight.

Ingestion should not be a route of exposure in a laboratory setting. The best way to eliminate exposure by ingestion is to limit actual contact with all chemicals. Wear gloves and practice good hygiene measures. Food and drink will not be stored in areas where chemicals are being used or stored. Label all chemical containers, and replace worn or faded labels ASAP.

Chemicals will not be tasted, and pipeting and siphoning of liquids will not be done by the mouth.

Injection
Exposure to chemicals by injection seldom occurs in the chemical laboratory. However, it can inadvertently occur through injury from metal or glass contaminated with chemicals or when chemicals are handled in syringes. Attention to detail and adherence to general standard operating procedures will provide control against accidental injection exposure.

Red boxes will be used to collect all used needles and syringes. Separate collection containers will be used to collect broken glass. Label the containers, "**CAUTION - Broken Glass**".

See also your Laboratory Waste Management Procedures.

Personal Protection Equipment Section

How do you handle pesticides or herbicides at your facility?

Hazard warning means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s). (See the definitions for "physical hazard" and "health hazard" to determine the hazards which must be covered.)

The Hazard Communication Standard (HCS) is based on a simple concept -- that employees have both a need and a right to know the hazards and identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring. The HCS is designed to provide employees with the information they need.

Personal Protective Equipment

Purpose

Your Employer is required to provide all Employees with required PPE to suit the task and known hazards. This Chapter covers the requirements for Personal Protective Equipment with the exception of PPE used for respiratory protection or PPE required for hazardous material response to spills or releases. Applicable OSHA Standards are 1910 Subpart 1 App B and 1910.120 App B, 132, 133, 136, and 138.

General Rules

Design

All personal protective equipment shall be of safe design and construction for the work to be performed.

Hazard Assessment and Equipment Selection

Hazard analysis procedures shall be used to assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the following actions will be taken:

1) Select, and have each affected Employee use, the proper PPE.
2) Communicate selection decisions to each affected Employee.
3) Select PPE that properly fit each affected employee.

Defective and damaged equipment.

Defective or damaged personal protective equipment shall not be used.

Training

All Employees who are required to use PPE shall be trained to know at least the following:

1) When PPE is necessary.
2) What PPE is necessary?
3) How to properly don, remove, adjust, and wear PPE.
4) The limitations of the PPE.
5) The proper care, maintenance, useful life and disposal of the PPE.

Each affected Employee shall demonstrate an understanding of the training and the ability to use PPE properly before being allowed to perform work requiring the use of PPE.

Certification of training for PPE is required by OSHA and shall be accomplished by using the Job Safety Checklist to verify that each affected Employee has received and understood the required PPE training.

Personal Protective Equipment Selection

Controlling Hazards

PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound manufacturing practices.

Selection Guidelines

The general procedure for selection of protective equipment is to:

a) become familiar with the potential hazards and the type of protective equipment that is available, and what it can do; i.e., splash protection, impact protection, etc.

b) compare the hazards associated with the environment; i.e., impact velocities, masses, projectile shape, radiation intensities, with the capabilities of the available protective equipment;

c) select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards

d) fit the user with the protective device and give instructions on care and use of the PPE. It is very important that end users be made aware of all warning labels for and limitations of their PPE.

Fitting the Device

Careful consideration must be given to comfort and fit. PPE that fits poorly will not afford the necessary protection. Continued wearing of the device is more likely if it fits the wearer comfortably. Protective devices are generally available in a variety of sizes. Care should be taken to ensure that the right size is selected.

Devices with Adjustable Features

Adjustments should be made on an individual basis for a comfortable fit that will maintain the protective device in the proper position. Particular care should be taken in fitting devices for eye protection against dust and chemical splash to ensure that the devices are sealed to the face. In addition, proper fitting of helmets is important to ensure that it will not fall off during work operations. In some cases a chin strap may be necessary to keep the helmet on an employee's head. (Chin straps should break at a reasonably low force, however, so as to prevent a strangulation hazard). Where manufacturer's instructions are available, they should be followed carefully.

Eye and Face Protection

Each affected employee shall use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

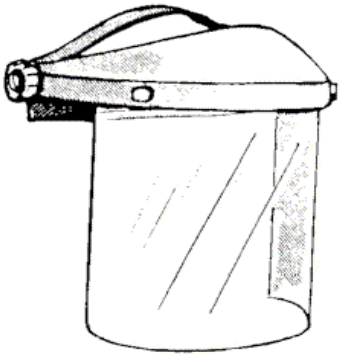
Each affected employee shall use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors are acceptable.

Each affected employee who wears prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or shall wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

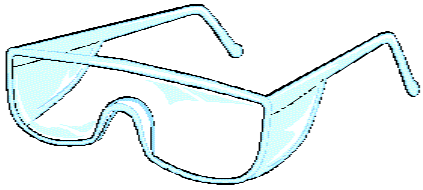
Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.

Each affected employee shall use equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. The following is a listing of appropriate shade numbers for various operations.

Filter Lenses for Protection Against Radiant Energy			
Operations	**Electrode Size 1/32 in**	**Arc Current**	**Protective Shade**
Shielded metal arc welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Torch brazing			3
Torch soldering			2
Note: as a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.			



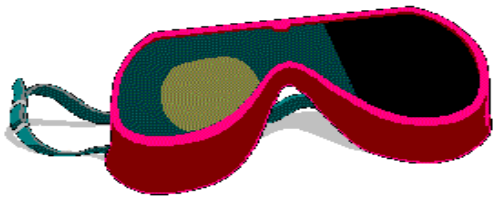
Eye Protection is a Requirement When Working With Hazardous Materials



Safety Glasses (spectacles)

Safety glasses (spectacles) with side shields are the minimum level of eye protection required for any type of work with or around hazardous chemicals or chemical products.

- Prescription glasses (with or without side shields) are not an acceptable substitution for safety glasses. Prescription safety glasses are available.
- Safety glasses do not provide complete protection against splash or spray because they do not fit tightly to your face.
- Safety glasses must meet ANSI Z87.1 standards (It will be marked on the frame).
- Safety glasses must be worn anytime chemicals or chemical products are handled.



Goggles, Splash (indirect venting)

Splash goggles are your next level of defense against chemical eye injury. Splash goggles have indirect ventilation and form a tight seal to the face.

- Splash goggle must be worn anytime there is the chance of a chemical splash or spray.
- Safety glasses are not an acceptable substitution for goggles and do not provide complete protection against splash or spray because they do not fit tightly to your face.
- Operations requiring goggles include but are not limited to pouring, scrubbing, rinsing, spraying (aerosols), washing, and dispensing.
- Splash goggles must also meet ANSI Z87.1 standards.

Face Shield

Face shields protect the eyes, face, and neck from chemical splashes and spray as well as flying particles.

- Face shields will not be worn independently. In other words, safety glasses or goggles must be worn underneath face shields for complete protection.

- Face shields are necessary anytime there is a severe risk of splash or spray or if the material in use is highly hazardous, for example highly corrosive alkaline material.
-

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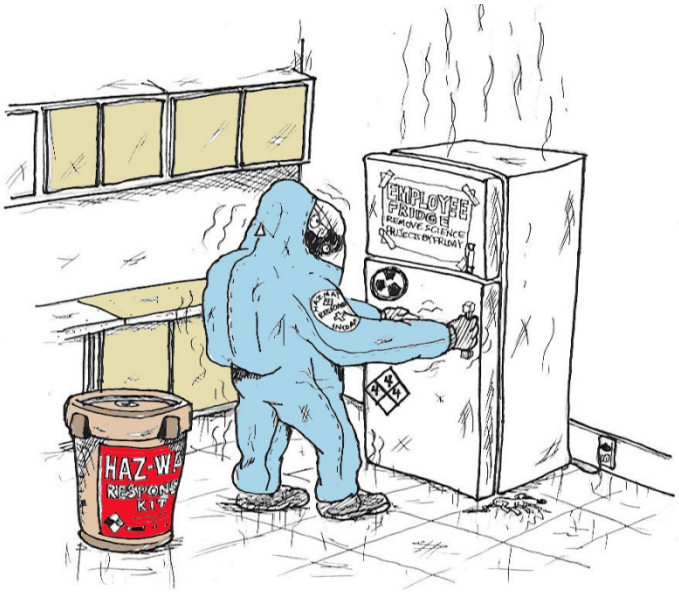
Selection chart guidelines for eye and face protection

The following chart provides general guidance for the proper selection of eye and face protection to protect against hazards associated with the listed hazard "***source***" operations.

Source	Hazard	Protection
IMPACT - Chipping, grinding machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Spectacles with side protection, goggles, face shield For severe exposure, use face shield
HEAT-Furnace operation and arc welding	Hot sparks	Face shields, spectacles with side. For severe exposure use faceshield.
CHEMICALS-Acid and chemical handling, degreasing, plating	Splash	Goggles, eyecup and cover types. For severe exposure, use face shield.
DUST - Woodworking, buffing, general, buffing, general dusty conditions.	Nuisance dust	Goggles, eye cup and cover type



Selection Guidelines for Head Protection

All head protection is designed to provide protection from impact and penetration hazards caused by falling objects.

Head protection is also available which provides protection from electric shock and burn. When selecting head protection, knowledge of potential electrical hazards is important.

Class A helmets, in addition to impact and penetration resistance, provide electrical protection from low-voltage conductors (they are proof tested to 2,200 volts).

Class B helmets, in addition to impact and penetration resistance; provide electrical protection from high-voltage conductors (they are proof tested to 20,000 volts).

Class C helmets provide impact and penetration resistance (they are usually made of aluminum which conducts electricity), and should not be used around electrical hazards.

Where falling object hazards are present, helmets must be worn. Some examples include: working below other workers who are using tools and materials which could fall; working around or under conveyor belts which are carrying parts or materials; working below machinery or processes which might cause material or objects to fall; and working on exposed energized conductors.

Foot Protection

General Requirements

Each affected employee shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where employee's feet are exposed to electrical hazards.

Selection Guidelines for Foot Protection

Safety shoes and boots provide both impact and compression protection. Where necessary, safety shoes can be obtained which provide puncture protection. In some work situations, metatarsal protection should be provided, and in other special situations electrical conductive or insulating safety shoes would be appropriate.

Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and, for other activities where objects might fall onto the feet.

Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts), around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet.

Safety shoes or boots with puncture protection would be required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees, causing a foot injury.

Reading a gas meter and writing the values down.

Hand Protection

General Requirements

Hand protection is required when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.

Selection guidelines for hand protection

Selection of hand PPE shall be based on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified. Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure.

There is no glove that provides protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. Before purchasing gloves, request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated. Other factors to be considered for glove selection in general include:

(A) As long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly change cheaper gloves than to reuse more expensive types.

(B) The work activities of the employee should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure of the hazard, and the physical stresses that will be applied.

Selection of gloves for protection against chemical hazards:

(A) The toxic properties of the chemical(s) must be determined; in particular, the ability of the chemical to cause local effects on the skin and/or to pass through the skin and cause systemic effects.

(B) Generally, any "**chemical resistant**" glove can be used for dry powders;

(C) For mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials.

(D) Employees must be able to remove the gloves in such a manner as to prevent skin contamination.

Protective Clothing Applications

A. The purpose of chemical protective clothing and equipment is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered during hazardous materials operations. During chemical operations, it is not always apparent when exposure occurs. Many chemicals pose invisible hazards and offer no warning properties.

B. These guidelines describe the various types of clothing that are appropriate for use in various chemical operations, and provides recommendations in their selection and use. The final paragraph discusses heat stress and other key physiological factors that must be considered in connection with protective clothing use.

C. It is important that protective clothing users realize that no single combination of protective equipment and clothing is capable of protecting you against all hazards. Thus protective clothing should be used in conjunction with other protective methods. For example, engineering or administrative controls to limit chemical contact with personnel should always be considered as an alternative measure for preventing chemical exposure.

The use of protective clothing can itself create significant wearer hazards, such as heat stress, physical and psychological stress, in addition to impaired vision, mobility, and communication. In general, the greater the level of chemical protective clothing, the greater the associated risks. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. Overprotection as well as under-protection can be hazardous and should be avoided.

II. DESCRIPTIONS.
A. PROTECTIVE CLOTHING APPLICATIONS.
1. Protective clothing must be worn whenever the wearer faces potential hazards arising from chemical exposure. Some examples include:

- Emergency response;
- Chemical manufacturing and process industries;
- Hazardous waste site cleanup and disposal;
- Asbestos removal and other particulate operations; and
- Agricultural application of pesticides.

2. Within each application, there are several operations which require chemical protective clothing. For example, in emergency response, the following activities dictate chemical protective clothing use:

- ✓ **Site Survey**: The initial investigation of a hazardous materials incident; these situations are usually characterized by a large degree of uncertainty and mandate the highest levels of protection.

- ✓ **Rescue**: Entering a hazardous materials area for the purpose of removing an exposure victim; special considerations must be given to the contamination of the victim and to how the selected protective clothing may affect the ability of the wearer to carry out rescue.

- ✓ **Spill Mitigation**: Entering a hazardous materials area to prevent a potential spill or to reduce the hazards from an existing spill (i.e., applying a chlorine kit on railroad tank car). Protective clothing must accommodate the required tasks without sacrificing adequate protection.

- ✓ **Emergency Monitoring**: Outfitting personnel in protective clothing for the primary purpose of observing a hazardous materials incident without entry into the spill site. This may be applied to monitoring contract activity for spill cleanup.

- ✓ **Decontamination**: Applying decontamination procedures to personnel or equipment leaving the site; in general, a lower level of protective clothing is used by personnel involved in decontamination.

B. THE CLOTHING ENSEMBLE. The approach in selecting personal protective clothing must encompass an "**ensemble**" of clothing and equipment items which are easily integrated to provide both an appropriate level of protection and still allow one to carry out activities involving chemicals. In many cases, simple protective clothing by itself may be sufficient to prevent chemical exposure, such as wearing gloves in combination with a splash apron and faceshield (or safety goggles).

1. The following is a checklist of components that may form the chemical protective ensemble:

- ➢ Protective clothing (suit, coveralls, hoods, gloves, boots);
- ➢ Respiratory equipment (SCBA, combination SCBA/SAR, air purifying respirators);
- ➢ Cooling system (ice vest, air circulation, water circulation);
- ➢ Communications device;
- ➢ Head protection;
- ➢ Eye protection;
- ➢ Ear protection;
- ➢ Inner garment; and
- ➢ Outer protection (overgloves, overboots, flashcover).

2**. Factors that affect the selection of ensemble components include:**

- ✓ How each item accommodates the integration of other ensemble components. Some ensemble components may be incompatible due to how they are worn (e.g., some SCBA's may not fit within a particular chemical protective suit or allow acceptable mobility when worn).

- ✓ The ease of interfacing ensemble components without sacrificing required performance (e.g. a poorly fitting overglove that greatly reduces wearer dexterity).

- ✓ Limiting the number of equipment items to reduce donning time and complexity (e.g. some communications devices are built into SCBA's which as a unit is NIOSH certified).

C. LEVEL OF PROTECTION.

1. Table VIII:1-1 lists ensemble components based on the widely used EPA Levels of Protection: Levels A, B, C, and D. These lists can be used as the starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection.

For example, if an emergency response activity involves a highly contaminated area or if the potential of contamination is high, it may be advisable to wear a disposable covering such as Tyvek coveralls or PVC splash suits, over the protective ensemble.

TABLE VIII:1-1. EPA LEVELS OF PROTECTION

LEVEL A:

Vapor protective suit (meets NFPA 1991)
Pressure-demand, full-face SCBA
Inner chemical-resistant gloves, chemical-resistant safety boots, two-way radio communication
OPTIONAL: Cooling system, outer gloves, hard hat
Protection Provided: Highest available level of respiratory, skin, and eye protection from solid, liquid and gaseous chemicals.
Used When: The chemical(s) have been identified and have high level of hazards to respiratory system, skin and eyes. Substances are present with known or suspected skin toxicity or carcinogenity. Operations must be conducted in confined or poorly ventilated areas.
Limitations: Protective clothing must resist permeation by the chemical or mixtures present. Ensemble items must allow integration without loss of performance.

LEVEL B:

Liquid splash-protective suit (meets NFPA 1992)
Pressure-demand, full-facepiece SCBA
Inner chemical-resistant gloves, chemical-resistant safety boots, two-way radio communications, Hard hat.
OPTIONAL: Cooling system, outer gloves
Protection Provided: Provides same level of respiratory protection as Level A, but less skin protection. Liquid splash protection, but no protection against chemical vapors or gases.
Used When: The chemical(s) have been identified but do not require a high level of skin protection. Initial site surveys are required until higher levels of hazards are identified. The primary hazards associated with site entry are from liquid and not vapor contact.
Limitations: Protective clothing items must resist penetration by the chemicals or mixtures present. Ensemble items must allow integration without loss of performance.

LEVEL C:

Support Function Protective Garment (meets NFPA 1993)
Full-facepiece, air-purifying, canister-equipped respirator
Chemical resistant gloves and safety boots
Two-way communications system, hard hat
OPTIONAL: Faceshield, escape SCBA
Protection Provided: The same level of skin protection as Level B, but a lower level of respiratory protection. Liquid splash protection but no protection to chemical vapors or gases.

Used When: Contact with site chemical(s) will not affect the skin. Air contaminants have been identified and concentrations measured. A canister is available which can remove the contaminant. The site and its hazards have been completely characterized.
Limitations: Protective clothing items must resist penetration by the chemical or mixtures present. Chemical airborne concentration must be less than IDLH levels. The atmosphere must contain at least 19.5% oxygen.
Not Acceptable for Chemical Emergency Response

LEVEL D:
Coveralls, safety boots/shoes, safety glasses or chemical splash goggles
OPTIONAL: Gloves, escape SCBA, face-shield
Protection Provided: No respiratory protection, minimal skin protection.
Used When: The atmosphere contains no known hazard. Work functions preclude splashes, immersion, potential for inhalation, or direct contact with hazard chemicals.
Limitations: This level should not be worn in the Hot Zone. The atmosphere must contain at least 19.5% oxygen.
Not Acceptable for Chemical Emergency Response

D.
2. The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the chemical situation or process increases, and when workers are required to perform different tasks. Personnel should upgrade or downgrade their level of protection only with concurrence with the site supervisor, safety officer, or plant industrial hygienist.

3. The recommendations in Table VIII:1-1 serve only as guidelines. It is important for you to realize that selecting items by how they are designed or configured alone is not sufficient to ensure adequate protection. In other words, just having the right components to form an ensemble is not enough. The EPA levels of protection do not define what performance the selected clothing or equipment must offer. Many of these considerations are described in the "**limiting criteria**" column of Table VIII: 1-1. Additional factors relevant to the various clothing and equipment items are described in subsequent Paragraphs.

E. ENSEMBLE SELECTION FACTORS.
2. **Chemical Hazards**. Chemicals present a variety of hazards such as toxicity, corrosiveness, flammability, reactivity, and oxygen deficiency. Depending on the chemicals present, any combination of hazards may exist.

3. **Physical Environment**. Chemical exposure can happen anywhere: in industrial settings, on the highways, or in residential areas. It may occur either indoors or outdoors; the environment may be extremely hot, cold, or moderate; the exposure site may be relatively uncluttered or rugged, presenting a number of physical hazards; chemical handling activities may involve entering confined spaces, heavy lifting, climbing a ladder, or crawling on the ground. The choice of ensemble components must account for these conditions.

4. **Duration of Exposure**. The protective qualities of ensemble components may be limited to certain exposure levels (e.g. material chemical resistance, air supply). The decision for ensemble use time must be made assuming the worst case exposure so that safety margins can be applied to increase the protection available to the worker.

5. **Protective Clothing or Equipment Available**. Hopefully, an array of different clothing or equipment is available to workers to meet all intended applications. Reliance on one particular clothing or equipment item may severely limit a facility's ability to handle a broad range of chemical exposures. In its acquisition of equipment and clothing, the safety department or other responsible authority should attempt to provide a high degree of flexibility while choosing protective clothing and equipment that is easily integrated and provides protection against each conceivable hazard.

F. CLASSIFICATION OF PROTECTIVE CLOTHING.
Personal protective clothing includes the following:

- ✓ Fully encapsulating suits;
- ✓ Non-encapsulating suits;
- ✓ Gloves, boots, and hoods;
- ✓ Firefighter's protective clothing;
- ✓ Proximity, or approach clothing;
- ✓ Blast or fragmentation suits; and
- ✓ Radiation-protective suits.

1. Firefighter turnout clothing, proximity gear, blast suits, and radiation suits by themselves are not acceptable for providing adequate protection from hazardous chemicals.

2. Table VIII:1-2 describes various types of protection clothing available, details the type of protection they offer, and lists factors to consider in their selection and use.

TABLE VIII: 1-2. TYPES OF PROTECTIVE CLOTHING FOR FULL BODY PROTECTION

Description
Type of Protection
Use Considerations

Fully encapsulating suit

- ✓ One-piece garment. Boots and gloves may be integral, attached and replaceable, or separate.
- ✓ Protects against splashes, dust gases, and vapors.
- ✓ Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a closed-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.

Non-encapsulating suit

- ✓ Jacket, hood, pants or bib overalls, and one-piece coveralls.
- ✓ Protects against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.

- ✓ Do not use where gas-tight or pervasive splashing protection is required. May contribute to heat stress in wearer. Tape-seal connections between pant cuffs and boots and between gloves and sleeves.

Aprons, leggings, and sleeve protectors

- ✓ Fully sleeved and gloved apron. Separate coverings for arms and legs. Commonly worn over nonencapsulating suit.

- ✓ Provides additional splash protection of chest, forearms, and legs.

Whenever possible, should be used over a nonencapsulating suit to minimize potential heat stress. Useful for sampling, labeling, and analysis operations. Should be used only when there is a low probability of total body contact with contaminants.

Firefighters' protective clothing

Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973, and boots (1974).

Protects against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consists of an outer shell, an inner liner and a vapor barrier with a minimum water penetration of 25 lb/in^2 (1.8 kg/cm2) to prevent passage of hot water.

Decontamination is difficult. Should not be worn in areas where protection against gases, vapors, chemical splashes or permeation is required.

Proximity garment (approach suit)

- ✓ One- or two-piece overgarment with boot covers, gloves, and hood of aluminized nylon or cotton fabric. Normally worn over other protective clothing, firefighters' bunker gear, or flame-retardant coveralls.

- ✓ Protects against splashes, dust, gases, and vapors.

- ✓ Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a closed-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.

Blast and fragmentation suit

- ✓ Blast and fragmentation vests and clothing, bomb blankets, and bomb carriers.

- ✓ Provides some protection against very small detonations. Bomb blankets and baskets can help redirect a blast.

- ✓ Does not provide for hearing protection.

Radiation-contamination protective suit

- ✓ Various types of protective clothing designed to prevent contamination of the body by radioactive particles.
- ✓ Protects against alpha and beta particles. Does not protect against gamma radiation.
- ✓ Designed to prevent skin contamination. If radiation is detected on site, consult an experienced radiation expert and evacuate personnel until the radiation hazard has been evaluated.

Flame/fire retardant coveralls.

- ✓ Normally worn as an undergarment.
- ✓ Provides protection from flash fires.
- ✓ Adds bulk and may exacerbate heat stress problems and impair mobility

III.

F. CLASSIFICATION OF CHEMICAL PROTECTIVE CLOTHING. Table VIII:1-3 provides a listing of clothing classifications. Clothing can be classified by design, performance, and service life.

Common Hazard Communication Acronyms

AAHAM	American Association of Healthcare Administrative Management
AAMVA	American Association of Motor Vehicle Administrator
AAPRO	American Association of Preferred Provider Organizations
ABI	Automated Broker Interface
ACER	Annual Contractor Evaluation Report
ACH	Automated Clearing House
ACORD	Agency-Company Organization for Research and Development
ACPE	American Council on Pharmaceutical Education
ACPS	Advanced Claims Processing System
ACR	American College of Radiology
ACR/NEMA	ACR/National Electrical Manufacturers Association
ACS	American College of Surgeons
ADA	American Dental Association
ADMD	Administration Management Domain
ADP	Automated Data Processing
ADR	Alternate Dispute Resolution
AEVCS	Automated Eligibility Verification Claims Submission
AFEHCT	Association for Electronic Health Care Transactions
AFT	Automated Funds Transfer
AGPA	American Group Practice Association
AGPAM	American Guild of Patient Account Managers
AHA	American Hospital Association
AHCPR	Agency for Health Care Policy and Research
AHIMA	American Health Information Management Association
AHP	Accountable Health Plan
AIAG	Automobile Industry Action Group
AIPSO	Auto Insurance Plans Service Office
AISO	Auto Insurance Services Group
AMA	American Medical Association
AMCR	Association for Managed Care Review
AMCRA	American Managed Care and Review Association
AMP	Automated Medical Payment
AMRA	American Medical Records Association
ANA	Article Numbering Association
ANSI	American National Standards Institute
AOA	American Osteopathic Association
APG	Ambulatory Patient Groups
API	Applications Program Interface
ARPA	Advanced Research Projects Agency
ARU	Audio Response Unit
ASAP	American Society for Automation in Pharmacy also, Analytic Systems Automated Purchasing
ASC	Accredited Standards Committees also, Ambulatory Surgical Center
ASCII	American Standard Code for Information Interchange
ASHMM	American Society for Hospital Materials Managers
ASN	Advanced Shipment Notice
ASTM	American Society of Testing Materials
ATA	Airline Transportation Association
ATG	Alignment Task Group

ATM	Asynchronous Transfer Mode also, Automated Teller Machine
BCBSA	Blue Cross and Blue Shield Association
BPS	Bits Per Second
BRMA	Brokers and Reinsurance Markets Association
BSC	Binary Synchronous Communications
BSR	Board of Standards Review also, Basic Semantic Repository
CALS	Computer Aided Acquisition and Logistics System
CAPA	Certified Aftermarket Parts Association
CAT	Catastrophic Claims
CBCP	Common Business Communications Protocol
IQCD	Cash Concentration and Disbursement
CCITT	Consultative Committee for International Telegraph and Telephone
CES	Clearinghouse Enforceability Services
CFR	Code of Federal Regulations
CHANDUS	Civilian Health and Medical Program of the Uniformed Services
CHAPS	Clearing House Automated Payments System
CHIPS	Clearing House Interbank Payments System
CHMIS	Community Health Management Information Systems
CHIN	Community Health Information Network
CHIPAS	Community Health Purchasing Alliance
CHN	Cooperative Healthcare Networks
CIAO	Construction Industry Action Group
CIDX	Chemical Industry Data Exchange
CIECA	Collision Industry Electronic Commerce Association
CII	Center for Informatization of Industry
CISG	Convention on the International Sale of Goods
CIU	Claims Investigative Unit
CLASS	Claims Acquisition and Submission System
CLIA	Clinical Laboratory Improvement Amendment
CMA	Cash Management Association
CMP	Comprehensive Medical Plans
COB	Coordination of Benefits
COS	Corporation for Open Systems
CPA	Canadian Payments Association also Canadian Petroleum Association
CPR	Computer-based Patient Record also, Comparative Performance Reports
CPRI	Computer-based Patient Records Institute, Inc.
CPS	Characters Per Second
CPT	Current Procedural Terminology
CQAS	Carrier Quality Assurance System
CR	Change Request
CRS	Commercially Reasonable Security
CSA	Canadian Standards Association
CSI	Customer Satisfaction Index
CTP	Corporate Trade Payment
CTX	Corporate Trade Exchange
CUIG	Credit Union Interchange Group
CV	Code Value
CWF	Common Working File
DCN	Document Control Number
DDT	Data Device Integration
DE	Data Element

DEA	Drug Enforcement Agency
DES	Data Encryption standard
DEX/UCS	Direct Exchange UCS
DFI	Depository Financial Institution
DISA	Data Interchange Standards Association, Inc.
DISH	Data Interchange for Shipping
DLTG	Delegate Liaison Task Group
DM	Data Maintenance
DIWERC	Durable Medical Equipment Regional Carriers
DMTF	Desktop Management Task Force
DMV	Department of Motor Vehicles
DOB	Date of Birth
DOD	Department of Defense
DOE	Direct Order Entry
DRP	Distribution Requirements Planning also, Direct Repair Program
DSD	Direct Store Delivery
DSTU	Draft Standard for Trial Use
DTTU	Draft Transaction for Trial Use
DUR	Drug Use/Utilization Reviews
DVR	Data Validation Reviews
EACH	Essential Access Community Hospital
EBCDIC	Extended Binary Coded Decimal Interchange Code
EC	Electronic Commerce also, European Community
ECE	Economic Commission of Europe
ECF	Extended Care Facility
ECR	Efficient Consumer Response
EDCD	UN/EDIFACT Composite Data Elements Directory
EDCL	UN/EDIFACT Code Lists
EDED	UN/EDIFACT Data Elements Directory
EDI	Electronic Data Interchange
EDIA	Electronic Data Interchange Association
EDICA	Electronic Data Interchange Council of Australia
EDEPACT	Electronic Data Interchange for Administration, Commerce and Transportation
EDIFICE	Electronic Data Interchange Forum for Companies Interested in Computing and Electronics
EDIM	Electronic Data Interchange Message
EDIX	Electronics Industry Data Exchange
EDM	Electronic Document Management
EDMD	UN/EDIFACT Standard Message Types Directory
EDSD	UN/EDIFACT Standard Data Segments Directory
EDPAF	Electronic Data Processing Auditors Foundation
EDS	Electronic Data Systems
EDX	Electronic Data Exchange
EEC	European Economic Community
EFT	Electronic Funds Transfer
EHNAC	Electronic Healthcare Network Accreditation Commission
EIAJ	Electronic Industry Association of Japan
EIDX	Electronic Industry Data Exchange
EIN	Employer Identification Number
EIS	Executive Information System

Email	Electronic Mail
EMC	Electronic Media Claims
EOB	Explanation of Benefits
EOQ	Economic Order Quantity
EPA	Environmental Protection Agency
EPP	EDEFACT Project Proposal
EPSDT	Early Periodic Screening Diagnostic Testing
ERA	Electronic Remittance Advise
ERISA	Employee Retirement Security Income Act
ERM	Electronic Record Management
ERS	Evaluated Receipts Settlement
ESDE	Environmental Safety Data Exchange
ESG	EDIFACT Steering Group
ESRD	End Stage Renal Dialysis
FA	Functional Acknowledgment
FACP	Final Administrative Cost Proposal
FAHS	Federation of American Health System
FARs	Federal Acquisition Regulations
FASB	Financial Accounting Standards Board
FCPA	Foreign Corrupt Practices Act
FDDI	Fiber Distribution Data Interface
FDO	Free Determining Official
FPS	Federal Information Processing Standard
FMC	Federal Maritime Commission
FN	Forward Notification
FOIA	Freedom of Information Act
FQHC	Federally Qualified Health Center
FTAM	File Transfer, Access and Management
FTP	File Transfer Protocol
FTS	Federal Telecommunications System
GAAP	Generally Accepted Accounting Principles
GAAS	Generally Accepted Auditing Standards
GAO	General Accounting Office
GHAA	Group Health Association of America
GOSIP	Government Open Systems Interconnection Profile
GSA	General Services Administration
GUS	Geographic Underwriting System
HCAD	Health Care Administrators
HCFA	Health Care Financing Administration
HCIN	Healthcare Information Network
HCPCS	HCFA Common Procedure Coding System
HCPR	Health Care Provider Records
HCRIS	Hospital Cost Report Information System
HCUP-3	Healthcare Cost and Utilization Project, 1988 - 1994
HDC	HCFA Data Center
HEDIC	Health Electronic Data Interchange Corporation
HEDIS	Health Plan and Employer Data and Information Set
HEDITP	Healthcare Electronic Data Interchange Trading Partner
HFMA	Healthcare Financial Management Association
HHS	Department of Health and Human Services
HIAA	Health Insurance Association of America

HIBCC	Health Industry Business Communications Council
HIDA	Health Industry Distributors Association
HIE	Health Insurance Enrollment
HIMA	Health Industry Manufacturers Association
HIMR	Health Insurance Master Record
HIMSS	Health Information and Management Systems Society
HIN	Health Industry Number
HIPC	Health Insurance Purchasing Cooperative
HIS	Hospital Information System
HISPP	Health Informatics System Planning Panel
HL7	Health Level 7
HMO	Health Maintenance Organization
HPSA	Healthcare Professional Shortage Area
IA	Interchange Agreement
IAG	Industry Action Group
IAIABC	International Association of Industrial Accident Boards and Commissions
IATA	International Airline Transport Association
ICC	international Chamber of Commerce
ICD-9	International Classification of Diseases, 9th Revision
ICED	Index of Co-Existent Disease
ICF	Intermediate Care Facility
ICN	Internal Control Number
ICOPS	Industry Committee for Office Products Standard
IDEA	International Data Exchange Association
IDMA	Insurance Data Management Association
IEC	International Electrotechnical Committee
IEDI	International Electronic Data Interchange
IEEE	Institute of Electrical and Electronic Engineers
IES	Inter-Enterprise System Clearing House
IETF	Internet Engineering Task Force
IFTM	International Forwarding and Transport Framework
IGP	Individual Group Practice
IHCEBI	Interactive Health Care Eligibility Benefits Inquiry
IHCEBR	Interactive Health Care Eligibility Benefits Response
III	Insurance Information Institute
IMG	International Medical Graduates
INS	International Network Services
IP	Internet Protocol
IPMS	Interpersonal Messaging Services
IPT	International Project Team
IRC	International Record Carrier
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISSB	Information Systems Standards Board
ISV	Independent Software Vendors
ITS	Inter-Plan Teleprocessing System
IV	Initialization Vector
IVANS	Insurance Value Added Network Service
IXRDA	Independent X-Ray Dealers Association
JAD	Joint Application Development
JCAHO	Joint Commission on the Accreditation of Health Organizations

JEDI	Joint Electronic Data Interchange
JIT	Just In Time
JRT	Joint Rapporteur Team
JTC I	Joint Technical Committee I
JTCIEDI	Joint Technical Committee for EDI
LAN	Local Area Network
LATA	Local Area and Transport Area
LIMNET	London Insurance Market Network
LIMRA	Life Insurance Marketing and Research Association
LOI	Letter of Intent
LRC	Longitudinal Redundancy Check
MAAC	Maximum Allowable Actual Charge
MAC	Message Authentication Code also, Maximum Allowable Cost
MAF	Medical Assisted Facility
MBA	Mortgage Bankers Association
MCO	Managed Care Organization
MDD	Maximum Daily Dose
MDG	Message Design Guidelines Group
MDN	Managed Data Networks
MEWA	Multiple Employer Welfare Arrangements
MGMA	Medical Group Management Association
MHS	Message Handling System
MMIS	Materials Management Information System
MNP	Microcom Network Protocol
MOMA	Message-Oriented Middleware Association
MOU	Memo of Understanding
MPI	Medicare Provider Identifier
MPIES	Medicare Physician Identification and Eligibility System
MS	Message Stores
MSDS	Materials Safety Data Sheets also, Message Standards Development Subcommittee
MTA	Message Transfer Agent
MTS	Medicare Transaction System
NABP	National Association of Boards of Pharmacy
NACHA	National Automated Clearing House Association
NACM	National Association of Credit Managers
NAEB	North American EDIFACT Board
NAGS	National Auto Glass Specifications, Inc,
NAHDO	National Association of Health Data Organizations
NAIC	National Association of Insurance Commissioners
NAII	National Association of Independent insurers
NAK	Negative Acknowledgement
NAMES	National Association of Medical Equipment Suppliers
NAAGC	National Association of Mutual Insurance Companies
NARA	National Archives and Records Administration
NATB	National Auto Theft, Bureau (now called NICB)
NBS	National Bureau of Standards
NCCI	National Council of Compensation Insurance
NCHS	National Center for Health Statistics
NCOIL	National Conference of Insurance Log4lators
NCP	Network Control Program

NCPDP	National Council for Prescription Drug Programs
NCQA	National Committee for Quality Assurance
NCSL	National Computer Standards Laboratory
NCVHS	National Committee for Vital & Health Statistics
NDM	Network Data Mover
NEIC	National Electronic Information Corporation
NEX/UCS	Network Exchange UCS
NHCAA	National Health Care Anti-Fraud Association
NICB	National Insurance Crime Bureau
NIST	National Institute for Standards of Technology
NMR	New Message Request
NMVTIS	National Motor Vehicle Title Information System
NN	Negative Notification
NOPA	National Office Products Association
NPF	National Provider File
NPI	National Provider Identifier
NSA	National Security Agency
NSC	National Supplier Clearinghouse
NSF	National Standard Format
NTFHR	National Task Force on Healthcare Reform
NUBC	National Uniform Billing Committee
NWC	National Workers Compensation Reinsurance Pool
NWDA	National Wholesale Druggists Association
O&P	Organization and Procedures
OBRA	Omnibus Budget Reconciliation Act
OCE	Open Collaborative Environment
OCHAMPUS	Office of Civilian Health and Medical Program of the Uniformed Services
OCR	Optical Character Recognition
ODETTE	Organization for Data Exchange Through Teletransmission
OFTP	ODETTE File Transfer Protocol
OIG	Office of Inspector General
OLTP	On-Line Transaction Processing
OM	Outcome Measurement
OMB	Office of Management and Budget
OMC	Office of Managed Care
OMG	Object Management Group
OPM	Organization and Procedure Manual
OPOP	Office of Provider Operations and Procedures
OSCAR	Online Survey and Certification and Reporting System
OSI	Open Systems Interconnection
OTP	Originating Trading Partner
P&C	Property and Casualty
PAD	Packet Assembler/Dissembler
PAEB	Pan American EDIFACT Board
PBM	Pharmacy Benefit Managers
PCS	Property Claims Services
PDAU	Physical Delivery Access Unit
PEB	Provider Electronic Billing
Pedi	Protocol for EDI
PIDX	Petroleum Industry Data Exchange
PIN	Personal Identification Number

PIP	Personal Injury Protection also, Periodic Interim Payment
PMA	Pharmaceutical Manufacturers Association
PMS	Practice Management System
PN	Positive Notification
POS	Point of Sale also, Point of Service
PP	Project Proposal
PPO	Preferred Provider Organization
PPSN	Public Packet Switched Network
PRB	Procedures Review Board
PS&R	Provider Statistics and Reporting System
PSTN	Public Switched Telephone Network
PTT	Post Telephone Telegraph Administration
QAP	Quality Assurance Program
QR	Quick Response
RA	Remittance Advice
RAA	Reinsurance Association of America
RBRVS	Resource Based Relative Value Scale
RDES	Regional Data Exchange System
RHHI	Regional Home Health Intermediary
RIMS	Reconsideration Information System
RINET	Reinsurance and Insurance Network
ROM	Regional Office Manual also, Read-Only Memory
RPCH	Rural Primary Care Hospital
RRC	Rural Referral Center
RT	Rapporteur's Advisory and Support Team
RTP	Receiving Trading Partner
RUG	Resource Utilization Group
SCC-JTC/EDI	Standards Council of Canada Joint Technical Committee on EDI
SCM	Shipping Container Marking
SDG	Syntax Development Group
SDLC	Synchronous Data Link Communication
SDO	Standards Developing Organization
SDS	Switched Digital Service.
SITA	Systeme Internationale Transport Aeronautique
SIU	Special Investigative Unit
SLA	Service Level Agreement
SMA	State Medicaid Agencies
SMDS	Switched Multimegabit Data Services
SNA	System Network Architecture
SNI	SNA Network Interconnect
SNADS	System Network Architecture Distribution Service
SNW	Simple Network Management Protocol
SONET	Synchronous Optical Network
SPBA	Society of Professional Benefit Administrators
SPIN	Standard Prescriber Identification Number
SPTG	Special Task Group
SPWG	Special Work Group
SSN	Social Security Number
SWIFT	Society for Worldwide Interbank Financial Telecommunications
T3POS	Transaction Processing Protocol for Point of Sale
TA	Technical Assessment

TAG	Technical Advisory Group also, Technical Assessment Groups
TCIF	Telecommunication Industry Forum
TCP/IP	Transmission Control Protocol Internet Protocol
TCP/IP FTP	Transmission Control Protocol/Internet Protocol - File Transfer Protocol
TCS	Trusted Computer System
TDCC	Transportation Data Coordinating Committee
TDF	Transborder Data Flow
TDI	Trade Data Interchange Also, Trading Data Interchange
TDI-AP	Trade Data Interchange - Applications Protocol
TEDIS	Trade Electronic Data Interchange Systems
TG	Task Group
TICD UN/	Draft Interactive Composite Data Elements Directory for UN/EDIFACT
TIMD UN/	Draft Interactive Messages Directory for UN/EDIFACT
TIN	Tax Identification Number
TP	Trading Partner
TPA	Third Party Administrators also, Trading Partner Agreement
TPSP	Third Party Service Provider
TR	Technical Report
TRACS	Trauma Registry of the American College of Surgeons
TDED	UN/EDIFACT Trade Data Element Directory
TS	Transaction Set
TSTS	Transaction Switching and Transport Service
UA	User Agent
UCC	Uniform Code Council
UCFTF	Uniform Claim Form Task Force
UCR	Usual, Customary, and Reasonable
UCS	Uniform Communications Standard
UN/ECE	United Nations Economic Commission for Europe
UN/EDIFACT	United Nations Electronic Data Interchange for Administration, Commerce, and Trade
UN/GTDI	UN/EDIFACT Guidelines for Trade Data Interchange
UN/ISO	United Nations International Standards Organization
UNCID	Uniform Rules of Conduct for Interchange of Trade Data by Teletransmission
UNID	Unique National Identifier
UNJEDI	United Nations Joint Electronic Data Interchange
UNSIM	UNEFACT Standard Interactive Message
UNSM	United Nations Standard Message
UNTDED	United Nations Trade Data Elements Directory
UNTDID	United Nations Trade Data Interchange Directory
UPC	Uniform Product Code
UPIN	Unique Physician Identification Number
UPC	Uniform Product Code
UPS	Uninterruptible Power Supply
URAC	Utilization Review Accreditation Commission
URO	Utilization Review Organization
USNC	United States National Committee
VAB	Value Added Bank
VAD	Value Added Distributor
VAN	Value Added Network
VAR	Value Added Reseller
VICS	Voluntary Industry Communications Standard

VIVM	Vendor Independent Messaging Interface
WWW	World Wide Web
WEDI	Work Group for Electronic Data Interchange
WG	Work Group
WNS	Warehouse Information Network Standard
X12C	Communications and Controls
X12E	Product Data
X12F	Finance
X12G	Government
X12H	Materials Management
X12I	Transportation
X12J	Technical Assessment
X12K	Purchasing
X12L	Industry Standards Transition
X12M	Distribution and Warehousing
X12N	Insurance

GLOSSARY

Aerosols means any non-refillable receptacles made of metal, glass or plastics and containing a gas compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state or in a gaseous state. Aerosol includes aerosol dispensers.

Alloy means a metallic material, homogeneous the naked eye, consisting of two or more elements so combined that they cannot be readily separated by mechanical means. Alloys are considered to be mixtures for the purpose of classification under the GHS.

Aspiration means the entry of a liquid or solid chemical product into the trachea and lower respiratory system directly through the oral or nasal cavity, or indirectly from vomiting;

ASTM means the "American Society of Testing and Materials".

BCF means "bioconcentration factor".

BOD/COD means "biochemical oxygen demand/chemical oxygen demand".

CA means "competent authority".

Carcinogen means a chemical substance or a mixture of chemical substances which induce cancer or increase its incidence.

CAS means "Chemical Abstract Service".

CBI means "confidential business information".

Chemical identity means a name that will uniquely identify a chemical. This can be a name that is in accordance with the nomenclature systems of the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS), or a technical name.

Competent authority means any national body(ies) or authority(ies) designated or otherwise recognized as such in connection with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Compressed gas means a gas which when packaged under pressure is entirely gaseous at -50°C; including all gases with a critical temperature less -50°C.

Contact sensitizer means a substance that will induce an allergic response following skin contact. The definition for "contact sensitizer" is equivalent to "skin sensitizer".

Corrosive to metal means a substance or a mixture which by chemical action will materially damage, or even destroy, metals.

Criteria means the technical definition for the physical, health and environmental hazards;

Critical temperature means the temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.

Dermal Corrosion: see *skin corrosion*;

Dermal irritation: see *skin irritation*.

Dissolved gas means a gas which when packaged under pressure is dissolved in a liquid phase solvent.

EC_{50} means the effective concentration of a substance that causes 50% of the maximum response.

EC Number or (ECN°) is a reference number used by the European Communities to identify dangerous substances, in particular those registered under EINECS.

ECOSOC means the "Economic and Social Council of the United Nations".

EINECS means "European Inventory of Existing Commercial Chemical Substances".

End Point means physical, health and environmental hazards;

ErC_{50}means EC_{50} in terms of reduction of growth rate.

EU means "European Union".

Explosive article means an article containing one or more explosive substances.

Explosive substance means a solid or liquid substance (or mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not emit gases.

Eye irritation means the production of changes in the eye following the application of test substance to the front surface of the eye, which are fully reversible within 21 days of application.

Flammable gas means a gas having a flammable range with air at 20°C and a standard pressure of101.3kPa.

Flammable liquid means a liquid having a flash point of not more than 93°C.

Flammable solid means a solid which is readily combustible, or may cause or contribute to fire through friction.

Flash point means the lowest temperature (corrected to a standard pressure of 101.3 kPa) at which the application of an ignition source causes the vapors of a liquid to ignite under specified test conditions.

Gas means a substance which (i) at 50 °C has a vapor pressure greater than 300 kPa; or (ii) is completely gaseous at 20 °C at a standard pressure of 101.3 kPa.

GESAMP means "the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection of IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP."

GHS means "the Globally Harmonized System of Classification and # Labeling of Chemicals".

Hazard category means the division of criteria within each hazard class, e.g., oral acute toxicity includes five hazard categories and flammable liquids includes four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

Hazard class means the nature of the physical, health or environmental hazard, e.g., flammable solid carcinogen, oral acute toxicity.

Hazard statement means a statement assigned to a hazard class and category that describes the nature of the hazards of a hazardous product, including, where appropriate, the degree of hazard;

IARC means the "International Agency for the Research on Cancer".

ILO means the "International Labor Organization".

IMO means the "International Maritime Organization".

Initial boiling point means the temperature of a liquid at which its vapor pressure is equal to the standard pressure (101.3kPa), i.e., the first gas bubble appears.

IOMC means the "Inter-organization Program on the Sound Management of Chemicals".

IPCS means the "International Program on Chemical Safety".

ISO means International Standards Organization.

IUPAC means the "International Union of Pure and Applied Chemistry".

Label means an appropriate group of written, printed or graphic information elements concerning a hazardous product, selected as relevant to the target sector(s), that is affixed to, printed on, or attached to the immediate container of a hazardous product, or to the outside packaging of a hazardous product.

Label element means one type of information that has been harmonized for use in a label, e.g., pictogram, signal word.

***LC_{50}* (50% lethal concentration)** means the concentration of a chemical in air or of a chemical in water which causes the death of 50% (one-half) of a group of test animals.

LD_{50} means the amount of a chemical, given all at once, which causes the death of 50% (one half) of a group of test animals.

L(E)C$_{50}$ means LC_{50} or EC_{50}.

Liquefied gas means a gas which when packaged under pressure, is partially liquid at temperatures above-50°C. A distinction is made between.

(i) High pressure liquefied gas: a gas with a critical temperature between -50°C and+65°C; and
(ii) Low pressure liquefied gas: a gas with a critical temperature above +65°C.

Liquid means a substance or mixture which at 50°C has a vapor pressure of not more than 300kPa (3bar), which is not completely gaseous at 20 °C and at a standard pressure of 101.3kPa, and which has a melting point or initial melting point of 20°C or less at a standard pressure of 101.3 kPa. A viscous substance or mixture for which a specific melting point cannot be determined shall be subjected to the ASTM D 4359-90 test; or to the test for determining fluidity (penetrometer test) prescribed in section 2.3.4 of Annex A of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

MARPOL means the "International Convention for the Prevention of Pollution from Ships".

Mixture means a mixture or a solution composed of two or more substances in which they do not react.

MSDS means "Material Safety Data Sheet" and in this document is used interchangeably with Safety Data Sheet (SDS).

Mutagen means an agent giving rise to an increased occurrence of mutations in populations of cells and /or organisms.

Mutation means a permanent change in the amount or structure of the genetic material in a cell;

NGO means "non-governmental organization".

NOEC means the "no observed effect concentration".

OECD means "The Organization for Economic Cooperation and Development".

Organic peroxide means a liquid or solid organic substance which contains the bivalent -0-0- structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulation (mixtures).

Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

Oxidizing liquid means a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

Oxidizing solid means a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

QSAR means "quantitative structure-activity relationships".

Pictogram means a graphical composition that may include a symbol plus other graphic elements, such as a border, background pattern or color that is intended to convey specific information.

Precautionary statement means a phrase (and/or pictogram) that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous product, or improper storage or handling of a hazardous product. ***Product identifier*** means the name or number used for a hazardous product on a label or in the SDS. It provides a unique means by which the product user can identify the substance or mixture within the particular use setting (e.g. transport, consumer or workplace).

Pyrophoric liquid means a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

Pyrophoric solid means a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

Pyrotechnic article means an article containing one or more pyrotechnic substances;

Pyrotechnic substance means a substance or mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining exothermic (heat-related) chemical reactions.

Readily combustible solid means powdered, granular, or pasty substance or mixture which is dangerous if it can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria means the latest revised edition of the United Nations publication bearing this title, and any published amendment thereto.

Recommendations on the Transport of Dangerous Goods, Model Regulations means the latest revised edition of the United Nations publication bearing this title, and any published amendment thereto.

Refrigerated liquefied gas means a gas which when packaged is made partially liquid because of its low temperature.

Respiratory sensitizer means a substance that induces hypersensitivity of the airways following inhalation of the substance.

RID means The Regulations concerning the International Carriage of Dangerous Goods by Rail [Annex 1 to Appendix B (Uniform Rules concerning the Contract for International Carriage of Goods by Rail) (CIM) of COTIF (Convention concerning international carriage by rail)], as amended.

SAR means "Structure Activity Relationship".

SDS means "Safety Data Sheet" and in this document is used interchangeably with Material Safety Data Sheet (MSDS).

Self-Accelerating Decomposition Temperature (SADT) means the lowest temperature at which self-accelerating decomposition may occur with substance as packaged.

Self-heating substance means a solid or liquid substance, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat; this substance differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

Self-reactive substance means a thermally unstable liquid or solid substance liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes substances or mixtures classified under the GHS as explosive, organic peroxides or as oxidizing.

Serious eye damage means the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the front surface of the eye, which is not fully reversible within 21 days of application.

Signal word means a word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The GHS uses 'Danger' and 'Warning' as signal words.

Skin corrosion means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours.

Skin irritation means the production of reversible damage to the skin following the application of a test substance for up to 4 hours.

Skin sensitizer means a substance that will induce an allergic response following skin contact. The definition for "skin sensitizer" is equivalent to "contact sensitizer".

Solid means a substance or mixture which does not meet the definitions of a liquid or gas.

SPR means "Structure Property Relationship".

Substance means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Substance which, in contact with water, emits flammable gases means a solid or liquid substance or mixture which, by interaction with water, is liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

Supplemental label element means any additional non-harmonized type of information supplied on the container of a hazardous product that is not required or specified under the GHS. In some cases this information may be required by other competent authorities or it may be additional information provided at the discretion of the manufacturer/distributor.

Symbol means a graphical element intended to succinctly convey information.

Technical name means a name that is generally used in commerce, regulations and codes to identify a substance or mixture, other than the IUPAC or CAS name, and that is recognized by the scientific community. Examples of technical names include those used for complex mixtures (e.g., petroleum fractions or natural products), pesticides (e.g., ISO or ANSI systems), dyestuffs (Color Index system) and minerals.

UNCED means the "United Nations Conference on Environment and Development".

UNCETDG/GHS means the "United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labeling of Chemicals".

UNITAR means the "United Nations Institute for Training and Research";

UNSCEGHS means the "United Nations Sub-Committee of Experts on the Globally Harmonized System of Classification and Labeling of Chemicals".

UNSCETDG means the "United Nations Sub-Committee of Experts on the Transport of Dangerous Goods".

Appendices

Appendix A

Comparison of MSDS/SDS Elements

The following tables provide a comparison of MSDS elements for the following:

- **Globally Harmonized System**[1]
- **ISO Safety Data Sheet for Chemical Products 11014-1: 2003 DRAFT** [2]
- **ANSI MSDS Preparation Z400.1- 2004** [3]
- **OSHA Hazard Communication Standard 29#CFR#1910.1200**[4]

MSDS Comparison				
MSDS Sections	**GHS SDS**[1]	**ISO MSDS**[2]	**ANSI MSDS**[3]	**OSHA MSDS**[4]
1. Product and company identification	▪ GHS product identifier. ▪ Other means of identification. ▪ Recommended use of the chemical and restrictions on use. ▪ Supplier's details (including name, address, phone number etc). ▪ Emergency phone number.	▪ GHS product identifier. ▪ Other means of identification. ▪ Recommended use of the chemical and restrictions on use. ▪ Supplier's details (including name, address, phone number etc). ▪ Emergency phone number.	▪ Product identity same as on label ▪ Product name, product code ▪ name, address and telephone number of supplier ▪ emergency telephone number	▪ Product identity same as on label. ▪ Name address and telephone number of the manufacturer, distributor, employer or other responsible party.
2. Hazards identification	▪ GHS classification of the substance/mixture and any	▪ GHS classification of the substance/mixture and any	▪ Emergency Overview (description of product and most	▪ health hazards including acute and chronic

MSDS Comparison				
MSDS Sections	**GHS SDS[1]**	**ISO MSDS[2]**	**ANSI MSDS[3]**	**OSHA MSDS[4]**
	regional information. ▪ GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) ▪ Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.	regional information. ▪ GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) ▪ Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.	significant immediate physical, health and environmental concerns) ▪ OSHA Regulatory Status ▪ Potential health effects (information on adverse human health effects and symptoms, relevant route(s) and length of exposure, type and severity of effects, target organs, medical symptoms that are aggravated by exposure) ▪ if listed as a carcinogen by OSHA, IARC, NTP ▪ environmental effects	effects, listing target organs or systems ▪ signs & symptoms of exposure ▪ conditions generally recognized as aggravated by exposure ▪ primary routes of exposure ▪ if listed as a carcinogen by OSHA, IARC, NTP ▪ physical hazards, including the potential for fire, explosion, and reactivity

3. Composition /in-formation on ingredients	***Substance*** ▪ Chemical identity ▪ Common name, synonyms, etc. ▪ CAS number, EC number, etc. ▪ Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. ***Mixture*** ▪ The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cut-off levels. ▪ Cut-off level for reproductive toxicity, carcinogenicity and	***Substance*** ▪ Chemical identity ▪ Common name, synonyms etc. ▪ CAS number, EC number, etc. ▪ Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. ***Mixture*** ▪ The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cut-off levels. ▪ Cut-off level for reproductive toxicity, carcinogenicity and	▪ common chemical name(s) ▪ generic name(s) ▪ synonyms ▪ CAS number(s) ▪ components or impurities contributing to the hazard (name, concentration)	▪ Chemical and common name of ingredients contributing to known hazards ▪ For untested mixtures, the chemical & common name of ingredients at 1% or more that present a health hazard and those that present a physical hazard in the mixture ▪ Ingredients at 0.1% or greater, if carcinogens

	category 1 mutagenicity is ³ 0.1% ▪ Cut-off level for all other hazard classes is ³ 1% Note: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification	category 1 mutagenicity is ³ 0.1% ▪ Cut-off level for all other hazard classes is ³ 1%		
4. First-aid measures	▪ Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact and ingestion. ▪ Most important symptoms/effects, acute and delayed. ▪ Indication of immediate medical attention and special treatment needed, if necessary.	▪ Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact and ingestion. ▪ Most important symptoms/effects, acute and delayed. ▪ Indication of immediate medical attention and special treatment needed, if necessary.	▪ first aid procedures by route of exposure, i.e., inhalation, skin contact, eye contact, ingestion ▪ important symptoms and effects useful for diagnostic treatment ▪ antidotes ▪ notes to a physician	▪ emergency & first aid procedures
5. Firefighting measures	▪ Suitable (and unsuitable) extinguishing	▪ Suitable (and unsuitable) extinguishing	▪ Qualitative flammable and reactivity	▪ generally applicable control

	media. ▪ Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). ▪ Special protective equipment and precautions for fire-fighters.	media. ▪ Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). ▪ Special protective equipment and precautions for firefighters.	properties ▪ suitable extinguishing media ▪ unsuitable extinguishing media ▪ Guidance to firefighters ▪ Specific hazards arising from the chemical ▪ Protective equipment and precautions for firefighters	measures ▪ flammable property information such as flashpoint ▪ physical hazards including the potential for fire, explosion, and reactivity
6. Accidental release measures	▪ Personal precautions, protective equipment and emergency procedures. ▪ Environmental precautions. ▪ Methods and materials for containment and cleaning up.	▪ Personal precautions, protective equipment and emergency procedures. ▪ Environmental precautions. ▪ Methods and materials for containment and cleaning up.	▪ Clean-up technique ▪ Personal Precautions ▪ Environmental Precautions ▪ containment technique ▪ regulatory information	▪ procedures for clean up of spills and leaks

7. Handling and storage	▪ Precautions for safe handling. ▪ Conditions for safe storage, including any incompatibilities.	▪ Precautions for safe handling. ▪ Conditions for safe storage, including any incompatibilities.	*handling* ▪ measures to prevent exposure and release, prevent fire or explosion and ensure precautions for safe handling *storage* ▪ storage conditions and technical measures for safe storage ▪ incompatibilities ▪ suitable/non suitable packaging material	▪ Precautions for safe handling & use, including appropriate hygenic practices.
8. Exposure controls/personal protection	▪ Control parameters (e.g., occupational exposure limit values or biological limit values). ▪ Appropriate engineering controls. ▪ Individual protection measures, such as personal protective equipment.	▪ Control parameters (e.g., occupational exposure limit values or biological limit values). ▪ Appropriate engineering controls. ▪ Individual protection measures, such as personal protective equipment.	▪ exposure guidelines (limit values) ▪ engineering controls to minimize hazards ▪ personal protective equipment (respiratory, hand, eye, skin and body protection) ▪ General Hygiene Considerations	▪ General applicable control measures ▪ appropriate engineering controls and work practices ▪ protective measures during maintenance & repair ▪ personal protective equipment ▪ permissible exposure

				levels, threshold limit values, listed by OSHA, ACGIH, or established company limits.
9. Physical and chemical properties	▪ Appearance (physical state, color, etc.) ▪ Odor ▪ Odour threshold ▪ pH ▪ melting point/freezing point ▪ initial boiling point and boiling range ▪ flash point: ▪ evaporation rate ▪ flammability (solid, gas) ▪ upper/lower flammability or explosive limits ▪ vapour pressure ▪ vapour density ▪ relative	▪ Appearance (physical state, color, etc.) ▪ Odor ▪ Odour threshold ▪ pH ▪ melting point/freezing point ▪ initial boiling point and boiling range ▪ flash point: ▪ evaporation rate ▪ flammability (solid, gas) ▪ upper/lower flammability or explosive limits ▪ vapour pressure ▪ vapour density ▪ relative	▪ appearance (color, physical form, shape) ▪ odor/odor threshold ▪ physical state ▪ pH ▪ melting/freezing point(specify which) ▪ initial boiling point and boiling range ▪ flash point ▪ evaporation rate ▪ flammability (solid, gas) ▪ upper/lower flammability or explosive limits ▪ vapor pressure ▪ vapor density ▪ specific gravity or	▪ characteristics of hazardous chemicals such as vapor pressure & density. ▪ physical hazards including the potential for fire, explosion, and reactivity.

	density: ▪ solubility(ies) ▪ partition coefficient: *n*-octanol/water ▪ auto-ignition temperature ▪ decomposition temperature	density: ▪ solubility(ies) ▪ partition coefficient: *n*-octanol/water ▪ auto-ignition temperature ▪ decomposition temperature	relative density ▪ solubility(ies) (specify solvent, e.g., water) ▪ partition coefficient: n-octanol/water ▪ auto-ignition temperature ▪ decomposition temperature. ▪ other relevant data	
10. Stability and reactivity	▪ Chemical stability. ▪ Possibility of hazardous reactions. ▪ Conditions to avoid (e.g., static discharge, shock or vibration). ▪ Incompatible materials, ▪ Hazardous decomposition products.	▪ Chemical stability. ▪ Possibility of hazardous reactions. ▪ Conditions to avoid (e.g., static discharge, shock or vibration). ▪ Incompatible materials. ▪ Hazardous decomposition products.	▪ Physical hazards ▪ chemical stability ▪ conditions to avoid ▪ Incompatible Materials ▪ hazardous decomposition products ▪ Possibility of Hazardous Reactions	▪ organic peroxides, pyrophoric, unstable # (reactive), or water-reactive hazards ▪ physical hazards, including reactivity and hazardous polymerization

11. Toxicological information	▪ Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: ▪ Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); ▪ Symptoms related to the physical, chemical and toxicological characteristics ▪ Delayed and immediate effects and also chronic effects from short- and long-term exposure;. ▪ Numerical	▪ Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: ▪ Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); ▪ Symptoms related to the physical, chemical and toxicological characteristics; ▪ Delayed and immediate effects and also chronic effects from short- and long-term exposure; ▪ Numerical	▪ Toxicological information: human, animal, and in vitro data, SAR ▪ acute dose effects: single/ short-term exposures. (e.g., LD50, LC50). ▪ Repeated dose effects: (e.g., NOAEL) ▪ Irritation/Corrosivity ▪ Sensitization (skin and respiratory) ▪ Carcinogenicity ▪ Neurological effects ▪ Genetic effects (e.g., mutagenicity) ▪ Reproductive effects ▪ Developmental effects ▪ Target organ effects	▪ See also Section 2 [health hazards Including acute and chronic effects, listing target organs or systems ▪ signs & symptoms of exposure ▪ primary routes of exposure ▪ if listed as a carcinogen by OSHA, IARC, NTP]

	measures of toxicity (such as acute toxicity estimates).	measures of toxicity (such as acute toxicity estimates).		

12. Ecological information	▪ Ecotoxicity (aquatic and terrestrial, where available). ▪ Persistence and degradability ▪ Bioaccumulative potential ▪ Mobility in soil ▪ Other adverse effects	▪ Ecotoxicity (aquatic and terrestrial, where available). ▪ Persistence and degradability ▪ Bioaccumulative potential ▪ Mobility in soil ▪ Other adverse effects	▪ ecotoxicity acute and longterm (fish, invertebrates) ▪ persistence / degradability ▪ bioaccumulation / bioconcentration ▪ mobilty: air, soil, water ▪ Other adverse effects	▪ No present requirements.
13. Disposal considerations	▪ Description of waste residues and information on their safe handling and methods of disposal, including any contaminated packaging.	▪ Description of waste residues and information on their safe handling and methods of disposal, including any contaminated packaging.	▪ safe and environmentally preferred waste management of the material and/or its container ▪ classification under applicable law	▪ No present requirements, ▪ See section 7,
14. Transport information	▪ UN number. ▪ UN Proper shipping name. ▪ Transport Hazard class(es). ▪ Packing group, if applicable. ▪ Marine pollutant (Y/N). ▪ Special precautions which a user needs to be	▪ UN number. ▪ UN Proper shipping name. ▪ Transport Hazard class(es). ▪ Packing group, if applicable. ▪ Marine pollutant (Y/N). ▪ Special precautions which a user needs to be	▪ proper shipping name ▪ hazard class(es) ▪ identification number ▪ packing group ▪ hazardous substances ▪ marine pollutants (Y/N) ▪ IMDG	▪ No present requirements,

	aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.	aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.	classification ▪ TDG classification ▪ ICAO/IATA classification ▪ RID/ADR classification	
15. Regulatory information	▪ Safety, health and environmental regulations specific for the product in question.	▪ Safety, health and environmental regulations specific for the product in question.	▪ U.S federal regulations ▪ international regulations ▪ U.S. state regulations	▪ No present requirements.
16. Other information	▪ Other information including information on preparation and revision of the SDS.	▪ Other information including information on preparation and revision of the SDS.	▪ label text ▪ hazard rating and rating system ▪ information on preparation and revision of safety data sheet ▪ Key/legend	▪ Date of preparation of MSDS or date of last change

1. Globally Harmonized System of Classification and Labeling of Chemicals (GHS), United Nations, 2005.
2. ISO 11014-1:2003 DRAFT Safety Data Sheet for Chemical Products.
3. American National Standard for Hazardous Industrial Chemicals-MSDS Preparation (ANSI Z-400.1-2004).
4. U.S. DOL, OSHA, 29 CFR 1910.1200, HAZCOM.

Appendix B

SDS Examples

(Fictional Products)

Appendix B-1

Bondit
(GHS MSDS Example)

1. Identification

Name of the product: Bondit
Recommended use: General adhesive.
Producer:
GHS Ltd., UK -
London, SE, Southwarkbridge 1

Telephone no. +44 171717 555.555 5,
Emergency no. +44 171717 333 333 3

2. Hazard(s) identification

Classification:
Flammable liquid, Category 2
Eye irritation, Category 2A
Hazardous to the aquatic environment, Acute Category 3

Labeling:

Symbol: Flame, Exclamation mark
Signal word: Danger
Hazard statement:
Highly flammable liquid and vapour.
Causes severe eye irritation.
Harmful to aquatic life.

Precautionary statements:
Keep container tightly closed.
Keep away from heat/sparks/open flame. - No smoking.
Wear protective gloves and eye/face protection.
Ground/Bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/ equipment.
Take precautionary measures against static discharge.
Use only non-sparking tools.
Store in cool/well-ventilated place.
Avoid release to the environment.

3. Composition / Information on ingredients

Chemical identity: Component A 70-80%
Common name: Solvent A
Numbers of identity: CAS-Nr.:111111-11-1
Impurities: None

Chemical identity: Component C 20-25%
Common name: Not applicable
Numbers of identity: CAS-Nr.: 44444-44-4
Impurities: none

4. First-aid measures

Inhalation:
Remove person to fresh air. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, give artificial respiration.

Skin contact:
Wash the contaminated area with soap and water. Remove contaminated clothing and wash before reuse. If irritation develops, get medical attention.

Eye contact:
Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Ingestion:
If swallowed, do NOT induce vomiting. Seek immediate medical attention.

5. Firefighting measures

Suitable extinguishing media: Foam, extinguishing powder, carbon dioxide, water fog. In case of fire, cool endangered containers with water fog.

Unsuitable extinguishing media: High pressure water jet.

Specific hazards in case of fire: None are known.

Special protective equipment and precaution for fire fighters: For fires in enclosed areas, wear self-contained breathing apparatus. Do not inhale combustion gases.

6. Accidental release measures

Personal precautions:
Depending on extent of release, consider the need for fire fighters/emergency responders with adequate personal protective equipment for cleaning up.

Do not eat, drink or smoke while cleaning up. Use a self-contained respirator, a mask with filter (type A class 3) or a filtering mask (e.g., EN 405). Wear protective clothing, safety glasses and impervious gloves (e.g., neoprene gloves). Ensure adequate ventilation. Avoid

all sources of ignition, hot surfaces and open flames (see also Section 7).

Environmental precautions:
Prevent spills from entering storm sewers or drains and contact with soil.

Methods and materials for containment and cleaning up:
Eliminate all ignition sources. Runoff may create fire or explosion hazard in sewer system. Absorb on fire retardant, liquid-absorbing material (treated sawdust, diatomaceous earth, sand). Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal (see also Section 13).

7. Handling and storage

Precautions for safe handling:
Avoid contact with eyes. Avoid prolonged repeated skin contact and breathing mists/vapours.

Use in well-ventilated area away from all ignition sources. Switch off all electrical devices such as parabolic heaters, hotplates, storage heaters etc. in good time for them to have cooled down before commencing work. Do not smoke; do not weld. Do not empty waste into sanitary drains. Take measures to prevent the buildup of electrostatic charge.

Conditions for safe storage, including incompatibilities:
Storage containers must be grounded and bonded. Store away from all ignition sources in a cool area equipped with an automatic sprinkling system. Ensure adequate ventilation. Store at temperatures between +5 and +50°C. Store only in the original container.

8. Exposure controls / personal protection

Information on the system design:
Draw off vapours directly at the point of generation and exhaust from the work area. In the case of regular work, provide bench-mounted extraction equipment.

Exposure Limits:

Component Name (CAS-No.)	Reference	TWA		STEL	
		ppm	mg/m3	ppm	mg/m3
	UK OEL	500	1200	--	--
Component C (4444-44-4)	German MAK	200	950	--	--

Ventilation:
Use in well-ventilated area with local exhaust.

Respiratory protection:
Approved respiratory equipment must be used when airborne concentrations are unknown or exceed the exposure limits. When processing large amounts, use a light duty construction compressed air line breathing apparatus (e.g., in accordance with EN1835), a mask with filter (type A class 3, colour brown) or a filtering half mask (e.g., in accordance

with EN 405) when there is inadequate ventilation.

Eye protection:
Safety glasses with side shields or chemical goggles must be worn.
Skin protection:
If prolonged or repeated skin contact is likely, neoprene gloves should be worn. Good personal hygiene practices should always be followed.

9. Physical and chemical properties

Physical state: Liquid
Colour: Colourless, transparent
Odour: Solvent, ester-like
Odour threshold: Not available
pH-value: Not applicable
Melting point: Not available
Freezing Point: Not available
Initial boiling point: 56°C
Flash point: - 22°C DIN 51755
Evaporation rate: Not available
Flammability (solid, gas): Not applicable
Explosion limits: lower limit = 1.4 Vol%; upper limit 13.0 Vol% (literature)
Vapour pressure: 240 mbar (highest partial vapour pressure) at 20°C
Vapour density: Not available
Relative density: 0.89 g/cm3 at 20°C
Solubility: Partially soluble in water at 20°C
Partition coefficient: Log Kow = 3.3
Auto-ignition temperature: Not available
Decomposition temperature: Not available

10. Stability and reactivity

Chemical stability: No decomposition, if used according to specifications.
Possibility of hazardous reactions: None are known.
Conditions to avoid: Heat, sparks, flame and buildup of static electricity.
Materials to avoid: Halogens, strong acids, alkalis and oxidizers.
Hazardous decomposition products: None are known.

11. Toxicological information

Acute Toxicity:

Test	Results	Basis
Oral Toxicity (Rats)	Not Classified	Based on Ingredients
Dermal Toxicity (Rats)	Not Classified	Product Test Data
Inhalation Toxicity, Vapor (Rats)	Not Classified	Based on Testing of Similar Materials
Eye Irritation (Rabbits)	Eye Irritant Category 2A	Based on Testing of Similar Materials
Dermal Irritation (Rabbits)	Not Classified	Product Test Data

Summary Comments: May cause severe eye irritation like ocular lesions, which are reversible.

Subchronic/Chronic Toxicity:

Test	Results	Comments
Dermal Sensitization (Guinea Pig)	Not Classified: Negative response in Bueller, guinea pig test. 0% animals considered positive.	Product Test Data

Summary Comments: Component A may have a drying effect on the skin; frequent or prolonged contact may cause flaking or cracking of the skin.

12. Ecological information

Persistence and degradability: The total of the organic components contained in the product is not classified as "readily biodegradable" (OECD-301 A-F). However, this product is expected to be inherently biodegradable.

Bio-accumulative potential: There is no evidence to suggest bioaccumulation will occur.

Mobility: Accidental spillage may lead to penetration in the soil and groundwater. However, there is no evidence that this would cause adverse ecological effects.

Aquatic Toxicity:

Test	Results	Comments
Acute Toxicity	Acute Category 3: 96 hr. LC_{50} = 65 mg/L	Product Test Data

13. Disposal considerations

Waste Disposal:
Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited by local regulation. The product is suitable for processing at an appropriate government waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

Recommended European waste code (EWC): 080406

14. Transport information

UN-number: 1993
UN proper shipping name: Flammable Liquid, N.O.S. (Contains Component C)
Transport hazard class: 3
Packing group: II
Marine Pollutant: No

15. Regulatory information

Inventory Status:
All components are on TSCA, EINECS/ELINCS, AICS, and DSL.

German:
Regulations governing combustible liquids (German-VbF) class: AI

German water endangering class (WGK) = 1, slightly water-endangering product (manufacturer classification.)

Australian Regulations:

AS 1940 Class: PGII
Poisons Schedule: S5

U.S. Regulations:

U.S. Superfund Amendments and Reauthorization Act (SARA) Title III:

SARA (311/312) HAZARD CATEGORIES:
FIRE, ACUTE

SARA 313: This product contains the following SARA 313 Toxic Release Chemicals.

Chemical Name	CAS Number	Concentration
Component A	111111-11-1	70-80%
Component C	4444-44-4	20-25%

The following product components are cited on the lists below:

Chemical Name	CAS Number	List Citations
Component A	111111-11-1	NJ RTK, TSCA 12(b)
Component C	4444-44-4	Prop. 65, NJ RTK

16. Other information

Abbreviations and acronyms:
UK OES = United Kingdom Occupational Exposure Standards
German MAK = Germany Maximum Allowable Concentration

MSDS Preparation date: July 1, 2005

The information contained herein is accurate to the best of our knowledge. My Company makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances.

Appendix B-2

Chemical Stuff
(GHS MSDS Example)

GHS SAFETY DATA SHEET

1. Identification

Product Name: Chemical Stuff
Synonyms: Methyltoxy Solution
CAS Number: 000-00-0
Product Use: Organic Synthesis
Manufacturer/Supplier: My Company
Address: My Street, Mytown, TX 00000

General Information: 713-000-0000
Transportation Emergency Number: CHEMTREC: 800-424-9300

2. Hazards Identification

GHS Classification:

Health	Environmental	Physical
Acute Toxicity - Category 2 (inhalation), Category 3 (oral/dermal) Eye Corrosion - Category 1 Skin Corrosion - Category 1 Skin Sensitization - Category 1 Mutagenicity - Category 2 Carcinogenicity - Category 1B Reproductive/Developmental - Category 2 Target Organ Toxicity (Repeated) - Category 2	Aquatic Toxicity - Acute 2	Flammable Liquid - Category 2

GHS Label:

Symbols: flame, skull and crossbones, corrosion, health hazard	
Hazard Statements **DANGER!** Highly Flammable Liquid and Vapor. Fatal if inhaled. Causes severe skin burns and eye damage. May cause allergic skin reaction. Toxic if swallowed and in contact with skin May cause cancer. Suspected of damaging the unborn child. Suspected of causing genetic defects. May cause damage to cardiovascular, respiratory, nervous, and gastrointestinal systems and liver and blood through prolonged or repeated exposure. Toxic to aquatic life.	***Precautionary Statements*** Do not eat, drink or use tobacco when using this product. Do not breathe mist/vapors. Keep container tightly closed. Keep away from heat/sparks/open flame. - No smoking. Wear respiratory protection, protective gloves and eye/face protection. Use only in a well-ventilated area. Take precautionary measures against static discharge. Use only non-sparking tools. Store container tightly closed in cool/well-ventilated place. Wash thoroughly after handling.

3. Composition / Information on Ingredients

Component CAS Number Weight %
Methyltoxy 000-00-0 80
(See Section 8 for Exposure Limits)

4. First Aid Measures

Eye: Eye irritation. Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Get immediate medical attention.

Skin: Itching or burning of the skin. Immediately flush the skin with plenty of water while removing contaminated clothing and shoes. Get immediate medical attention. Wash contaminated clothing before reuse.

Inhalation: Nasal irritation, headache, dizziness, nausea, vomiting, heart palpitations, breathing difficulty, cyanosis, tremors, weakness, red flushing of face, irritability. Remove exposed person from source of exposure to fresh air. If not breathing, clear airway and start cardiopulmonary resuscitation (CPR). Avoid mouth-to-mouth resuscitation.

Ingestion: Get immediate medical attention. Do not induce vomiting unless directed by medical personnel.

5. Fire Fighting Measures

Suitable Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish fire. Water may be ineffective but should be used to cool fire-exposed containers, structures and to protect personnel. Use water to dilute spills and to flush them away from sources of ignition.

Fire Fighting Procedures: Do not flush down sewers or other drainage systems. Exposed firefighters must wear NIOSH-approved positive pressure self-contained breathing apparatus with full-face mask and full protective clothing.

Unusual Fire and Explosion Hazards: Dangerous when exposed to heat or flame. Will form flammable or explosive mixtures with air at room temperature. Vapor or gas may spread to distant ignition sources and flash back. Vapors or gas may accumulate in low areas. Runoff to sewer may cause fire or explosion hazard. Containers may explode in heat of fire. Vapors may concentrate in confined areas. Liquid will float and may reignite on the surface of water.

Combustion Products: Irritating or toxic substances may be emitted upon thermal decomposition. Thermal decomposition products may include oxides of carbon and nitrogen.

6: Accidental Release Measures

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. (Also see Section 8).

Vapor protective clothing should be worn for spills and leaks. Shut off ignition sources; no flares, smoking or flames in hazard area. Small spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Large spills: Dike far ahead of liquid spill for later disposal.

Do not flush to sewer or waterways. Prevent release to the environment if possible. Refer to Section 15 for spill/release reporting information.

7. Handling and Storage

Handling
Do not get in eyes, on skin or on clothing. Do not breathe vapors or mists. Keep container closed. Use only with adequate ventilation. Use good personal hygiene practices. Wash hands before eating, drinking, smoking. Remove contaminated clothing and clean before re-use. Destroy contaminated belts and shoes and other items that cannot be decontaminated.

Keep away from heat and flame. Keep operating temperatures below ignition temperatures at all times. Use non-sparking tools.

Storage
Store in tightly closed containers in cool, dry, well-ventilated area away from heat, sources of ignition and incompatibles. Ground lines and equipment used during transfer to reduce the possibility of static spark-initiated fire or explosion. Store at ambient or lower temperature. Store out of direct sunlight. Keep containers tightly closed and upright when not in use. Protect against physical damage.

Empty containers may contain toxic, flammable and explosive residue or vapors. Do not cut, grind, drill, or weld on or near containers unless precautions are taken against these hazards.

8. Exposure Controls / Personal Protection

Exposure Limits

Component, Methyltoxy - TWA: 3 ppm (skin) - STEL: C 15 ppm (15 min.)

Engineering Controls: Local exhaust ventilation may be necessary to control air contaminants to their exposure limits. The use of local ventilation is recommended to control emissions near the source. Provide mechanical ventilation for confined spaces. Use explosion-proof ventilation equipment.

Personal Protective Equipment (PPE)

Eye Protection: Wear chemical safety goggles and face shield. Have eye-wash stations available where eye contact can occur.

Skin Protection: Avoid skin contact. Wear gloves impervious to conditions of use. Additional protection may be necessary to prevent skin contact including use of apron, face shield, boots or full body protection. A safety shower should be located in the work area. Recommended protective materials include:Butyl rubber and for limited contact Teflon.

Respiratory Protection: If exposure limits are exceeded, NIOSH approved respiratory protection should be worn. A NIOSH approved respirator for organic vapors is generally acceptable for concentrations up to 10 times the PEL. For higher concentrations, unknown concentrations and for oxygen deficient atmospheres, use a NIOSH approved air-supplied respirator.

Engineering controls are the preferred means for controlling chemical exposures. Respiratory protection may be needed for non-routine or emergency situations. Respiratory protection must be provided in accordance with OSHA 29 CFR 1910.134.

9. Physical and Chemical Properties

Flashpoint: 2°C (35°F)
Autoignition Temperature: 480°C (896°F)
Boiling Point: 77°C (170.6°F) @ 760 mm Hg
Melting Point: -82°C
Vapor Pressure: 100.0 mm Hg @ 23°C

Vapor Density(Air=1): 1.7; air = 1
% Solubility in Water: 10 @ 20ºC

Pour Point: NA
Molecular Formula: Mixture
Odor/Appearance: Clear, colorless liquid with mild, pungent odor.

Lower Flammability Limit: >3.00%
Upper Flammability Limit: <15.00%
Specific Gravity: 0.82g/ml @ 20°C
% Volatile: 100
Evaporation Rate (Water=1): 5(Butyl Acetate =1)
Viscosity: 0.3 cP @ 25°C
Octanol/Water Partition Coefficient: log K_{ow}: 0.5
pH: 7, 8% aqueous solution
Molecular Weight: Mixture

10. Stability and Reactivity

Stability/Incompatibility: Incompatible with ammonia, amines, bromine, strong bases and strong acids.

Hazardous Reactions/Decomposition Products: Thermal decomposition products may include oxides of carbon and nitrogen.

11. Toxicological Information

Signs and Symptoms of Overexposure: Eye and nasal irritation, headache, dizziness, nausea, vomiting, heart palpitations, difficulty breathing, cyanosis, tremors, weakness, itching or burning of the skin.

Acute Effects:

Eye Contact: may cause severe conjunctival irritation and corneal damage.

Skin Contact: may cause reddening, blistering or burns with permanent damage. Harmful if absorbed through the skin. May cause allergic skin reaction.

Inhalation: may cause severe irritation with possible lung damage (pulmonary edema).

Ingestion: may cause severe gastrointestinal burns.

Target Organ Effects: May cause gastrointestinal (oral), respiratory tract, nervous system and blood effects based on experimental animal data. May cause cardiovascular system and liver effects.

Chronic Effects: based on experimental animal data, may cause changes to genetic material; adverse effects on the developing fetus or on reproduction at doses that were toxic to the mother. Methyltoxy is classified by IARC as group 2B and by NTP as reasonably anticipated to be a human carcinogen. OSHA regulates Methyltoxy as a potential carcinogen.

Medical Conditions Aggravated by Exposure: preexisting diseases of the respiratory tract, nervous system, cardiovascular system, liver or gastrointestinal tract.

Acute Toxicity Values
Oral LD_{50} (Rat) = 100 mg/kg
Dermal LD_{50} (Rabbit) = 225-300 mg/kg
Inhalation LC_{50} (Rat) = 200 ppm/4 hr., 1100 ppm vapor/1 hr

12. Ecological Information

LC_{50} (Fathead Minnows) = 9 mg/L/96 hr.
EC_{50} (Daphnia) = 8.6 mg/L/48 hr.

Bioaccumulation is not expected to be significant. This product is readily biodegradable.

13. Disposal Considerations

As sold, this product, when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR 261). It is listed as Hazardous Waste Number Z000, listed due to its toxicity. The transportation, storage, treatment and disposal of this waste material must be conducted in compliance with 40 CFR 262, 263, 264, 268 and 270. Disposal can occur only in properly permitted facilities. Refer to state and local requirements for any additional requirements, as these may be different from Federal laws and regulations. Chemical additions, processing or otherwise altering this material may make waste management information presented in the MSDS incomplete, inaccurate or otherwise inappropriate.

14. Transport Information

U.S. Department of Transportation (DOT)
Proper Shipping Name: Methyltoxy
Hazard Class: 3, 6.1
UN/NA Number: UN0000
Packing Group: PG 2
Labels Required: Flammable Liquid and Toxic

International Maritime Organization (IMDG)
Proper Shipping Name: Methyltoxy
Hazard Class: 3 Subsidiary 6.1
UN/NA Number: UN0000
Packing Group: PG 2
Labels Required: Flammable Liquid and Toxic

15. Regulatory Information

U.S. Federal Regulations
Comprehensive Environmental Response and Liability Act of 1980 (CERCLA):
The reportable quantity (RQ) for this material is 1000 pounds. If appropriate, immediately report to the National Response Center (800/424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies.

Toxic Substances Control Act (TSCA): All components of this product are included on the TSCA inventory.

Clean Water Act (CWA): Methyltoxy is a hazardous substance under the Clean Water Act. Consult Federal, State and local regulations for specific requirements.

Clean Air Act (CAA): Methyltoxy is a hazardous substance under the Clean Air Act. Consult Federal, State and local regulations for specific requirements.

Superfund Amendments and Reauthorization Act (SARA) Title III Information:

SARA Section 311/312 (40 CFR 370) Hazard Categories:
Immediate Hazard: X
Delayed Hazard: X
Fire Hazard: X
Pressure Hazard:
Reactivity Hazard:

This product contains the following toxic chemical(s) subject to reporting requirements of SARA Section 313 (40 CFR 372)

Component CAS Number Maximum %
Methyltoxy 000-00-0 80

State Regulations

California: This product contains the following chemicals(s) known to the State of California to cause cancer, birth defects or reproductive harm:

Component CAS Number Maximum %
Methyltoxy 000-00-0 80

International Regulations

Canadian Environmental Protection Act: All of the components of this product are included on the Canadian Domestic Substances list (DSL).

Canadian Workplace Hazardous Materials Information System (WHMIS):
Class B-2 Flammable Liquid
Class D-1-B Toxic
Class D-2-A Carcinogen
Class D-2-B Chronic Toxin
Class E Corrosive

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

European Inventory of Existing Chemicals (EINECS): All of the components of this product are included on EINECS.

EU Classification: F Highly Flammable; T Toxic; N Dangerous to the Environment
EU Risk (R) and Safety (S) Phrases:
R11: Highly flammable.
R23/24/25: Toxic by inhalation, in contact with skin and if swallowed.
R37/38: Irritating to respiratory system and skin.
R41: Risk of serious damage to eyes.
R43: May cause sensitization by skin contact.
R45: May cause cancer.
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S53: Avoid exposure - obtain special instructions before use.
S16: Keep away from sources of ignition - No Smoking.
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S9: Keep container in a well-ventilated place.
S36/37: Wear suitable protective clothing and gloves.
S57: Use appropriate container to avoid environmental contamination.

16. Other Information

National Fire Protection Association (NFPA) Ratings: This information is intended solely for the use of individuals trained in the NFPA system.

Health: 3
Flammability: 3
Reactivity: 0

Revision Indicator: New MSDS

Disclaimer: The information contained herein is accurate to the best of our knowledge. My Company makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances.

References

References for Section 1.
ANSI Z129.1: American National Standard for Hazardous Industrial Chemicals-Precautionary Labeling.

Australia: Australia Worksafe, National Occupational Health and Safety Commission, Approved Criteria for Classifying Hazardous Substances (1994).

CPSC FHSA: U.S. CPSC, 16 CFR 1500, FHSA regulations.

DOT: U.S. DOT, 49 CFR Part 173, Subpart D.

EPA FIFRA: U.S. EPA, 40 CFR Part 156, FIFRA regulations.

EU: Council Directive 92/32/European Economic Community, amending for the 7th time, Directive 67/548/European Economic Community, approximation of the laws, regulations and administrative provisions on the classification, packaging and labeling of dangerous preparations.

GHS: Globally Harmonized System of Classification and Labeling of Chemicals, United Nations, 1st Revised Edition 2005.

IATA: International Air Transport Association's Dangerous Goods Regulations.

ICAO: International Civil Aviation Organization's Technical Instructions for the Safe Transport Of Dangerous Goods By Air.

IMO: International Maritime Organization's International Maritime Dangerous Goods (IMDG) Code.

Japan: Japanese Official Notice of Ministry of Labor No. 60 "Guidelines for Labeling of the Danger and Hazards of Chemical Substances".

Korea: Korean Ministry of Labor Notice 1997-27 "Preparation of MSDS and Labeling Regulation".

Malaysia: Malaysian Occupational Safety and Health Act (1994), Act 514 and Regulations (1994).

Mexico: Dario Oficial (March 30, 1996) NORMA Oficial Mexicana NOM-114-STPS-1994.

NFPA: National Fire Protection Association, 704 Standard, System for the Identification of Fire Hazards of Materials, 2001.

NPCA HMIS: National Paint and Coatings Association, Hazardous Materials Identification System, 2001.

OSHA HCS: U.S. DOL, OSHA, 29 CFR 1910.1200.

WHMIS: Controlled Products Regulation, Hazardous Products Act, Canada Gazette, Part II, Vol. 122, No. 2, 1987.

References for Section 2.0:
GHS Chapter 1.1 Purpose, Scope and Application of the GHS.
GHS Chapter 1.3 Classification of Hazardous Substances and Mixtures.

References for Section 3.0:
GHS Chapter 1.3. Classification of Hazardous Substances and Mixtures.
GHS Part 2. Physical Hazards.
GHS Part 3. Health Hazards.
GHS Part 4. Environmental Hazards
GHS Annex 8. An Example of Classification in the GHS.
GHS Annex 9. Guidance on Hazards to the Aquatic Environment.
GHS Annex 10. Guidance on Transformation/Dissolution of Metals and Metal Compounds in Aqueous Media

References for Section 4:
GHS Chapter 1.4. Hazard Communication: Labeling.
GHS Chapter 1.5. Hazard Communication: Safety Data Sheets.
GHS Annex 1 Allocation of Label Elements.
GHS Annex 2 Classification and Labeling Summary Tables.
GHS Annex 3 Precautionary Statements and Precautionary Pictograms.
GHS Annex 4 Guidance on the preparation of Safety Data Sheets
GHS Annex 5 Consumer Product Labeling Based on the Likelihood of Injur.
GHS Annex 6 Comprehensibility Testing Methodology.
GHS Annex 7 Examples of Arrangements of GHS Label Elements.

References for Government and Private Standards:

Canada
Hazardous Products Act: Controlled Products Regulations; Consumer Chemical and Container Regulations, 2001 Pest Control Products Act; Transportation of Dangerous Goods Act. Health Canada GHS Website

European Union (EU)
Directive 67/548/EEC (consolidated, 7th revision).

Directive 2001/59/EC adapting to technical progress for the 28th time Council Directive 67/548/EEC.

Manual of decisions, implementation for the sixth and seventh amendments to Directive 67/548/EEC on dangerous substances.

Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 related to the classification, packaging and labeling of dangerous reparations.

Commission Directive 91/155/EEC defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations (SDS.)

Directive 2001/58/EC (amending Directive 91/155/EEC) defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations (SDS).

Standards
American National Standard for Hazardous Industrial Chemicals - Precautionary Labeling (ANSI Z-129.1-2000).

American National Standard for Hazardous Industrial Chemicals - MSDS Preparation (ANSI Z400.1-2004).

ISO 11014-1:2003 DRAFT Safety Data Sheet for Chemical Products.

UN GHS
Globally Harmonized System of Classification and Labeling of Chemicals (GHS) ("The Purple Book"), United Nations, 2005 First Revised Edition, available online or from United Nations Publications. UN GHS website

UN TRANSPORT
UN Recommendations on the Transport of Dangerous Goods, Model Regulations (14th Revised Edition 2005).

UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, 4th Revised Edition

USA
OSHA Hazard Communication Standard 29 CFR 1910.1200.

CPSC Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq.*).

(FIFRA) Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 *et seq.*).

US EPA Label Review Manual (3rd Edition, August 2003) EPA 735-B-03-001.

Federal Hazardous Materials Transportation Law (49 U.S.C. 5101 *et seq.*).

USA websites:
The Globally Harmonized System for Hazard Communication. OSHA.
Globally Harmonized System (GHS) for Classification and Labeling of Chemicals. Environmental Protection Agency.
International Standards. U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.

GHS Focal Point websites:
International Labour Organization (ILO)
Organisation for Economic Co-Operation and Development

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