

DRAFT MODEL TRAINING PROGRAM FOR HAZARD COMMUNICATION

**U.S. Department of Labor
Occupational Safety and Health Administration**

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OVERVIEW

This document is designed to help employers provide effective training to employees who are exposed to hazardous chemicals, as required by the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS). Effective training is vital to understanding the information provided on chemical container labels and material safety data sheets, and applying that information in the workplace to protect against chemical hazards.

The document is composed of three sections. First, an introduction provides a brief explanation of the training requirements of the HCS, and how the Model Training Program is designed to assist in meeting those requirements. Second is a section providing guidance for site-specific training. OSHA recognizes that the training needs and resources available to employers can vary considerably. This section is intended to assist employers in tailoring training to the circumstances found in their workplace. In the third section, general elements common to all HCS training programs are covered, along with several categories of chemical hazards. This section presents an approach to providing training using a series of lesson plans, slides, and quizzes. These lesson plans, slides, and quizzes are provided in appendices. Employers are encouraged to adapt this generic information to their workplaces. Additional appendices provide a glossary of commonly used terms and references that can provide additional information.

This guidance document provides a description of a suggested approach to training employees about chemical hazards. OSHA recognizes that many employers may not have the need for as comprehensive a training program as would result from implementation of all of the elements presented in the Model Training Program. The Agency hopes that such employers will find the portions of the Model Training Program that apply to their workplace to be useful.

This document is advisory in nature and informational in content. It does not alter or determine compliance responsibilities, which are set forth in the Hazard Communication Standard (29 CFR 1910.1200) and in the Occupational Safety and Health Act. Moreover, because interpretations and enforcement policy may change over time, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts for additional guidance on OSHA compliance requirements.

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I. INTRODUCTION

A. Why do we need a Model Training Program?

The Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS) is designed to protect against chemical source illnesses and injuries by ensuring that employers and employees are provided with sufficient information to recognize chemical hazards and take appropriate protective measures. Employers are required to provide this information through comprehensive chemical hazard communication programs that include material safety data sheets (MSDSs), labels, and worker training. Employers may find it challenging to institute and maintain effective hazard communication training, either because of a lack of understanding of what kind of training is required, or because of a lack of knowledge on how to conduct effective training. This Model Training Program has been developed to help employers comply with the training requirements of the HCS.

I. What are the training requirements of the HCS?

We will look first at the overall purpose of the training program, and then at an explanation of the specific requirements.

1. Purpose of the Training Program

The purpose of hazard communication training is to explain and reinforce the information presented to employees through the written mediums of labels and material safety data sheets, and to apply this information in their workplace. Labels and material safety data sheets will only be successful when employees understand the information presented and are aware of the actions to be taken to avoid or minimize exposure, and thus the occurrence of adverse effects.

Training helps to integrate and classify the many pieces of information that relate to chemical hazard communication. In a typical workplace, a worker may be confronted with posted hazard warnings, signs, tags, incoming labels, workplace labels, material safety data sheets (MSDSs), manuals explaining the company hazard communication program, lists of chemicals, and information furnished by the union. This wide variety of communications will differ in format, content and reading level. These differences can obscure the important hazard communication message. Training can reduce this background "noise" by presenting the necessary information in a structured and logical manner.

Training sessions serve another important purpose - they provide a forum for employees to share their health and safety concerns, and to obtain answers from managers and occupational health and safety professionals. Employees can also share their ideas and job experiences - they often have acquired real expertise in dealing with potentially hazardous situations.

2. Specific Requirements

Paragraph (h) of the HCS addresses employee information and training. The requirements reflect the overall purpose of the standard. Some key words and phrases have been underlined:

a. First, *employers should 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 physical or health hazard that employees have not been previously trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (such as flammability or carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and material safety data sheets.*

b. Second, *employees shall be informed of:*

- *the requirements of this section;*

- *any operations in their work area where hazardous chemicals are present;*
 - *the location and availability of the written hazard communication program, including the required list of hazardous chemicals, and material safety data sheets required by this section.*
- c. Third, *employee training shall include at least:*
- *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.);*
 - *the physical and health hazards of the chemicals in the work area;*
 - *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*
 - *the details of the hazard communication program developed by the employer, including an explanation of labels and material safety data sheets, and how employees can obtain and use the appropriate hazard information.*

C. What do all these information and training requirements mean?

Let's look at the underlined words in turn.

Effective means that the information and training program must work. Employees must carry the knowledge from the training into their daily jobs. For example, if asked, they should know where hazardous chemicals are present in their work area, and should also know how to protect themselves.

In their work area means just what it says. The information and training must be specific to each work area. You can't stop at training about general hazards found in work areas; you have to address the potential hazards that employees are actually going to encounter.

Time of initial assignment. This means that new employees must be informed and trained before going on the job, so that they are not faced with unknown hazards.

New physical or health hazard. Sometimes new hazardous chemicals are introduced into the workplace, and sometimes employees are assigned to new jobs that involve potential exposure to new hazards. Either way, no employee should be in the position of encountering unfamiliar or unknown hazards.

Categories of hazards. OSHA is aware that many workplaces contain so many different chemicals that it would be difficult and confusing to attempt to train employees about each one separately. Fortunately, many chemicals fall into categories, such as flammables or acids and bases. In these instances, it is not only acceptable but also more effective to discuss the hazards of the category as a whole. If individual chemicals within a category present a special safety or health hazard, these unique properties must be pointed out.

Specific chemicals are those that don't belong in a category or should be singled out for some other reason. For example, they may present a special hazard, or be represented in great quantity in the workplace.

Chemical-specific information must always be available through labels and material safety data sheets. Whether categories or any other training method is selected, labels and MSDSs must always be available and accessible to employees at all times.

Informed. Providing information is not quite the same as training, but we have included both under the general term “training” in this Model Training Program. It means that employees must know what the standard means and where things are kept. Information can be furnished with the help of signs, notices, handouts, or other means. Whatever information measures are chosen, however, they must be effective. For example, employees should be able to tell you where the written program is housed, and also to locate the material safety data sheet collection.

Requirements of this section are simply the requirements of the HCS. It is a good idea here to inform the employees about the rights and responsibilities of the employer as well as the employee.

Operations in their work area. This phrase points again to the need to be specific in the information and training program. Generalities about operations that have no relevance to these specific employees are not sufficient.

Location and availability must again be specific. For example, the written hazard communication program may be kept in Building A or in the supervisor’s office, where it must be available at all times. Employees should know exactly where it is and how to gain access.

Training. This term covers anything that is done to impart new knowledge or skills or to refresh employees’ memories on previously learned knowledge or skills. It can best be imagined as bridging the gap between what employees know now and what they have to know to identify hazards and protect themselves against them. Many different training methods and media can be used to achieve this goal.

Methods and observations mean any active or passive means that can be used to detect the presence or release of a hazardous chemical. For example, some chemicals such as chlorine can be detected by their odor, color or other unique properties.

Physical and health hazards. These terms apply only to the physical and health hazards of chemicals. A *physical hazard* is associated with a chemical that is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable or water-reactive. All these can harm as a result of physical reaction. *Health hazard* means that exposure to the chemical can cause acute or chronic health effects. Examples are carcinogens and eye irritants.

Measures employees can take to protect themselves. These can include any control, including everything from learning the meaning of emergency signals to observing “No Entry” areas or selecting the correct personal protective equipment.

Details of the hazard communication program. This allows employees to learn what label statements mean, what information can be found in the material safety data sheet, and how to find out if a chemical presents a potential hazard.

The HCS contains further definitions in Paragraph (c).

D. What are some common problems encountered with training?

In the brief definition above, we said that to be effective, training must “work.” Training sometimes does not work, for the following reasons:

- *Training is not the solution.* This means that poor performance by employees is not due to a lack of knowledge and skills. Other actions, such as the implementation of engineering controls, might be the better answer.
- *Training is too generic.* Instead of focusing on specific hazards in the workplace, some employers make the mistake of only showing videos that deal with industry situations in general. We will see later on how such videos can be incorporated into an effective program.
- *Special needs and preferences of adult learners are not taken into account.* We will offer some suggestions later on how adult learners prefer to learn.
- *Inappropriate training methods and media are selected.* Some employers have spent a great deal of money on training media that are not necessarily effective. Often, simple and inexpensive methods are more effective in achieving the goals of a hazard communication program.
- *There is no transfer of learning from the training setting to the job.* This commonly occurs when the training is a “one-shot” deal, with no further follow up in the work setting.
- *No evaluation of training effectiveness is made.* To make sure that training is achieving its goals, it is valuable to measure its effectiveness. This will tell you whether employees achieved the level of knowledge and skill that was expected. If they didn’t, appropriate revisions can be made and the training can thus be improved.
- *Documentation of training is not adequate.* Although there is no requirement to document training, it makes sense to maintain records. Recording class attendance is not enough; you also need to document what it was you set out to teach and how well you achieved it.

All of these issues will be addressed in Section II of the Model Training Program, which provides guidance on how to develop and administer an effective hazard communication training program.

E. What is in the Model Training Program, and how can it help me?

This Model Training Program is designed to help provide effective hazard communication training. In **Section II** we address the issue of effective and site-specific training. We have developed **Guidance for Site-Specific Training**, which follow and expand upon guidance that has been provided in OSHA’s Voluntary Training Guidelines (OSHA 2254). Included are the steps that lead to an effective program, as well as a discussion about how to assist employees who lack basic skills. Using the guidance, you can develop and administer hazard communication training programs that are specific to your own workplace.

In **Section III**, we identify training components that are not site-specific and apply to all employees. These are topics that are “portable” - they can stay with an employee when he or she goes from one work site to another. We have made these topics into training “modules.” They are self-contained lesson plans that you can use or adapt, as you choose. The Lesson Plans include visual aids that you can modify to reflect your site-specific hazard communication program. The visual aids can be printed out as handouts, made into overhead transparencies, or projected as a pdf file on screen. Also included at the end of each Lesson Plan is a quiz that you can print out for distribution. The Lesson Plans, which we have called General Elements, can be incorporated into your overall program, as discussed in Section II.

We have developed two kinds of General Elements. The first group covers topics that help employees to understand the HCS and the information that is communicated by MSDSs and labels. The second group covers four common chemical categories.

Lastly, we have added some **Appendices**. These include a section on where to go for further help, and a glossary of terms.

We hope that you will add your own ideas to the material supplied here.

II. Guidance for Site-Specific Training

A. What should I do first?

It is often necessary to prioritize hazard communication information and training needs. If you are responsible for a simple operation, using only one or two hazardous chemicals, it is not too difficult to plan your HCS information and training program. This is particularly true if your employee turnover is low. Employers, however, often use many different chemicals in their operations, and frequently hire new employees or transfer existing employees to new jobs. It is then necessary to prioritize training activities.

Prioritizing is easier if you do some homework first.

Prioritizing Hazard Communication Training

1. Use existing company records to define groups potentially exposed to hazardous chemicals:
 - Inventory of chemicals used, stored, or otherwise present in the workplace.
 - Index of MSDSs for hazardous materials.
 - Description of job tasks - gives information on potential exposures.
 - Further definitions of exposure groups obtained from industrial hygiene monitoring data.
2. Review previous training history:
 - Have all new employees been trained?
 - Have all employees assigned to new tasks, with potential new exposures, been trained?
 - What training has been conducted?
 - How often? How recently?
 - What was the content of training?
 - How effective was it? Do employees have the knowledge and/or skills to protect themselves against possible harm?

OSHA's Voluntary Training Guidelines suggest that employees can assist in this process by providing, "in writing, and in their own words, descriptions of their jobs. These should include the tasks performed, and the tools, materials and equipment used." It is also helpful to observe "employees at the work site as they perform tasks, asking about the work, and recording answers."

Let's look at a simple example:

George Foster is in the process of starting up a small manufacturing business. He has obtained MSDSs from the suppliers of the 10 potentially hazardous chemicals involved in the process, and has compiled an inventory. All 20 employees are new to the job. There is no

record of their ever having received previous hazard communication training. George's prioritization task is fairly easy:

- *All employees potentially exposed to hazardous chemicals must be informed and trained before going on the job.*
- *Five of the employees are office workers. There is little likelihood that they will ever be exposed to the chemicals. However, because the operation is small, and the office employees potentially may have errands in the work areas, George chooses to include them in basic information and training.*
- *All 15 operations employees need basic information and training as well. They must be informed about such things as the location and availability of the written program. They also need to be trained about general hazard communication elements, such as understanding the HCS, understanding MSDSs, and understanding labels.*
- *At the site-specific level, 10 of the employees will work in an Area A where only 6 of the chemicals are used. By studying the MSDSs, George realizes that 4 of these chemicals belong in the category of "flammables." They share common properties, and present the same type of hazard. He teaches about these as one category, remembering that the individual MSDS for each of the four still must be made available to employees.*
- *The remaining 2 chemicals in Area A have different properties. George has to address each of these separately, using the MSDSs as an aid.*
- *Of the 5 remaining employees, 2 work in Area B, where the 4 remaining chemicals present different hazards, and require site-specific training.*
- *Three employees perform maintenance duties, and George is aware that they are potentially exposed to all hazards, since their duties take them into both areas. George decides to spend extra time with them.*

George Foster's approach, based on these facts, is:

1. *Give all employees the general information and training (see Section III for hazard communication **General Elements for All Employees**). The office workers should be encouraged to receive this immediately, but have lower priority if everyone cannot be accommodated in one session.*
2. *Provide separate sessions for the Area A and Area B employees, but include maintenance personnel in both.*
3. *For Area A, train employees about flammables (see Section III, **General Elements—Chemical Information**, for a Lesson Plan on flammables), using the individual MSDSs as reference and backup. Instruct about the two remaining chemicals separately, as they are used specifically at that site.*
4. *For Area B, give site-specific training about the 4 chemicals present in the area.*
5. *Make sure that all pertinent MSDSs are available and accessible during all operational hours to employees in each of the areas.*
6. *Add other elements for the maintenance employees, as needed.*

This very simple example deals with a limited number of employees and chemical hazards. However, the same approach can be used in more complex situations.

B. How do I identify training needs?

Once you have made some general plans about training priorities, it is important to zero in on specific training needs. You need to diagnose the training task, and figure what types of learning are pertinent for effective results. There are three areas to consider. We will call them *Task Analysis*, *Population Considerations*, and *Resource Considerations*. They involve the following kinds of questions:

- *Task Analysis* - What jobs are involved? What kinds of learning are appropriate?
- *Population Considerations* - What are the characteristics of your workforce? For example, what are the educational levels and work experience of the employees?
- *Resource Considerations* - What resources are available? For example, do you already have some training materials that could be used in the hazard communication training?

1. **Task Analysis**

a. Figuring who has to be trained about what.

In the Voluntary Training Guidelines, OSHA suggests that a job analysis be developed by examining engineering data on new equipment or the material safety data sheets (MSDSs) on unfamiliar substances. Another suggested option is to conduct a Job Hazard Analysis (see OSHA 3071). This is a procedure for studying and recording each step of a job, identifying existing or potential hazards, and determining the best way to perform the job in order to reduce or eliminate the risks. Information obtained from a Job Hazard Analysis can be used to identify which employees will need to be trained and also can generate content for the training activity.

For hazard communication training, however, the primary source of information is the MSDS, which spells out the type and extent of hazard for each chemical, in addition to all the measures that should be followed to protect employees and to deal with emergencies. Tying in the information on the MSDSs with a location by location inventory will show **who** has to be trained, and about **what**. Your job of determining the content of training is also made easier by the fact that all employees at potential risk from exposure to hazardous chemicals should receive training on the general elements, as described in the example of George Foster noted earlier.

b. Deciding on learning outcomes.

The second part of a task analysis is to look at the desired outcomes of training. We already have seen what the purpose and specific requirements are of the HCS. Now, you need to decide what types of learning output are appropriate. These decisions will have a major impact on the types of training methods and media you select, and also the cost. For example, do you want employees to *know* something, such as the location of the emergency shower, or do you want them to master some *skill*, such as donning a respirator? The training approach is quite different for these types of learning.

The term “knowledge” itself covers several different levels of complexity of learning. Although the HCS requires that workers be trained concerning the chemical hazards in their workplace, it is unproductive to try to teach workers to memorize the meanings of terms such as “teratogen.” It is much more efficient to communicate the risks in everyday terms and to provide a glossary for reference purposes. Different levels of knowledge and skills are:

Recognition. The interpretation of warning signs is an example of a situation where the recognition level is appropriate. It would be foolish to require an employee to memorize all words on warning signs and to reproduce them, correctly spelled, in a quiz. It is better if the worker *recognizes* a sign saying DANGER and takes the appropriate action. The signs present images through the use of shapes, colors, and signal words that are meant to trigger certain actions, such as donning safety glasses. Training for recognition is simple to conduct once the

purpose of the training is clearly identified. For training about signs, a discussion using color slides or a pamphlet containing pictures and explanations will be more effective than an elaborate chemistry or spelling program that misses the underlying purpose.

Discrimination. Discrimination requires an employee to know what a thing is or is not in comparison with other objects or situations. For example, many work facilities have a system of emergency audible alarms or whistles that indicate situations ranging from *emergency evacuation* to *listen for further direction*. Each signal is meaningful only in the context of the others. Similarly, discrimination is required in selecting the correct personal protective equipment to protect against different kinds of hazards. For example, a supervisor needs to consider all possible choices before deciding that in a situation involving exposures to both dusts and organic vapors, which of several types of chemical cartridges for a respirator would be most appropriate. The training in these instances should present the range of choices and give practice at comparing or contrasting them. Job aids such as charts or tables in which the characteristics are listed or shown pictorially are useful tools in teaching discrimination.

Understanding. Obviously, employees need to *understand* the HCS, the chemical hazards in the workplace, and the measures they and the employer should take to protect their health and safety. One of the biggest problems that employers have in implementing an HCS information and training program is their own understanding of this term. Some employers may incorrectly think, for example, that it means that they have to train workers to “understand” scientific terminology at the same level as a health professional. Some programs have attempted to teach employees to reproduce the origin and history of the MSDS, or to reproduce technical terms by rote memory. Such efforts are not only time-consuming and expensive - they are actually counterproductive. They bring unwanted “noise” to the true training goal. Instead of memorizing technical material, employees need to be able to recognize and understand the basics of important health and safety information. Reference guides and handouts are preferable to memorization in this context.

In other contexts, and for other tasks, the need to “understand” might require a different type of training activity. For example, using the MSDS to identify the correct types of extinguishing agents to use on different types of fires might, on closer examination, be a simple discrimination task, such as those described above. When the desired learning outcomes are clearly defined, the appropriate training methods will also become clear.

Skills. Skills training means that the employee has to “do” something rather than “know” something, although all skills training contains elements of knowledge. Skills training involves the actual performance, with guidance, of the target skill. It helps if the task is broken down into a series of steps, so that each step is mastered before the entire task is attempted.

Skills are acquired most effectively if:

- the trainer gives an overview of the entire task, explaining essential nomenclature.
- the trainer performs the task, describing the sequence as it progresses.
- the employee performs the task, with guidance and reminders.
- the employee practices alone, or with a coworker.
- recognition is given for skill mastery.

2. Population Considerations

Assessment of the people to be trained is the second leg of the three-legged Training Needs Assessment stool. Training that is not appropriate to the characteristics of the employee

population is always ineffective. Factors such as average age, educational level, and language difficulties will influence the way you do your training and the kinds of examples that you use.

a. Age and length of service.

An aging workforce can present special training challenges. The original training may have been conducted many years ago, and may not even be relevant today. Often, on-the-job training has consisted of watching an experienced worker perform the job, which may have resulted in picking up poor safety habits. On the other hand, experienced older workers are less likely to make mistakes made by new or newly assigned workers. They can be a resource to the trainer by giving good and bad examples of health and safety practices, and can be helpful in orienting new workers. They may be more comfortable with written manuals and instructions than younger workers who have grown up in the electronic age. Special concerns related to hearing loss or reduction of visual acuity may dictate a slightly different training approach.

b. Educational level and language differences.

Educational level, language differences and present level of job-specific knowledge will have a great impact upon the methods and media that you select for training. They should not act as barriers to effective communication about hazards. Trainers may encounter a range of educational levels. For example, if you are responsible for researchers in a laboratory, they tend to get bored and “turned off” by simple explanations of the HCS. On the other hand, many groups have limited reading and writing skills, or limited vocabularies due to language differences. Another common experience is to design a training program based on assumptions that employees lack knowledge, only to find that most of the employees already know most of the material. For an experienced group of workers, you may want to consider administering a “pre-quiz,” using the quizzes that accompany each Lesson Plan. This way, you can establish their level of knowledge. You can thus avoid unnecessary duplication of training time and effort and focus in on the areas where they need help.

The lesson learned from these experiences is to gather as much information as possible about the employee population before developing the training. Questions to be asked include:

- What are the educational levels of the employees? Would it be logical to use different training approaches for different groups, such as for laboratory researchers and other members of the workforce? You might investigate special computer assisted instruction programs for individual employees who may take longer to learn, or look at other options that will be discussed later.
- Do all employees speak, read and write English adequately? If not, you will have to consider giving instruction to some employees in their native language, or using aids such as pictograms and signs.
- How much work experience do employees have? Experienced workers can contribute to the HCS training of new employees.
- What kind of training methods have been used successfully with this same group of employees for other training, such as job training or training to meet the requirements of other OSHA standards?
- Is there any documentation of previous HCS training? This is an important point, since it cannot be assumed that prior training has occurred.

3. Resource Considerations

Even the simplest training programs require some resources, in terms of time spent in training, availability of space, and materials. It is up to the manager or supervisor to come up with an HCS training program that is effective but uses resources efficiently. Major considerations are:

a. Budget.

Large companies usually have a budget assigned for training. Costs charged to this budget may include:

- the research, training, and time of the persons who develop, present and document the training.
- costs of outside consultants who assist with these functions.
- manuals, handouts, purchased audiovisual packages and other materials.
- equipment, training aids, and record-keeping systems.
- extra costs, such as rented space for training sessions.
- time taken to follow up on the effectiveness of training.
- employees' on the job training time.

Smaller companies usually have smaller budgets. However, these employers can conduct effective HCS training by using several different strategies, which are described in Section II D 4, *Selection of Methods and Media*.

b. Location and shift work considerations.

Most health and safety in the real world has to be planned and conducted in the face of many physical constraints. The type of location, the presence or absence of training facilities, and scheduling problems are all important factors. As a "worst case" situation, consider the job of a trainer whose employees are strung out in very small groups along a pipeline, or in small marketing operations. Or think of the logistical problems presented when workers are captive on offshore oil drilling platforms for one or two weeks at a time, and are allowed to go home to towns all over the country on their off-duty weeks. An entirely different scenario is seen in manufacturing operations, where many employees are doing similar jobs, and can be trained in groups. Shift work also presents logistical and scheduling problems; companies who have presented training at the end of a shift usually have experienced difficulties in maintaining focus and interest.

These constraints have been overcome by ingenious planning. To return to the drilling platform example, oil companies have devised several strategies. One alternative has been to set up a regional or local training center, and to bring workers in from offshore for scheduled training. Another is to turn to techniques of individualized instruction, such as interactive video or other computer-assisted programs, self-paced paper-driven texts, or distance learning by satellite. Another option has been to appoint a traveling training coordinator who appears periodically to conduct all necessary training.

Whatever the constraints, many employers have adapted their training program to fit the unique needs of their workplace, and have been able to offer effective HCS training to their employees.

The three aspects of identifying training needs are summarized in the following checklist. You may want to expand on the checklist to reflect the characteristics of your own unique workplace.

Identifying Training Needs

Task Analysis:

How many different chemical classes/substances are there in the work areas?

Which chemical hazards are involved?

How many different job classifications?

How many employees in each classification?

How often are new processes involving chemical hazards introduced?

How often do you expect to receive new MSDSs?

Do you have any potentially hazardous chemicals in non-labeled pipes?

What General Elements are needed?

What site-specific training is needed?

What learning outcomes are needed?

Information to be made available?

Knowledge?

Skills?

Population Considerations:

What is the size of the group to be trained on any one topic?

How many different groups do you have?

What are the average ages of employees within the defined groups?

What length of service?

What is the rate of turnover (new hires, transfers)?

What educational levels?

Are there reading or learning difficulties?

Are there language differences?

How much work experience within groups?

Is there any documentation of prior training?

Resource Considerations:
What is your budget?
Do you have a room large enough to handle your groups? Do you have other options?
What assistance will be available?
What kinds of audiovisual aids are available?
What existing programs might be used?
What problems might you have in arranging the training (i.e., scheduling)?
How will you handle the training of shift workers?

C. How do I prepare training goals and objectives?

Hazard communication training programs, like any other activity, are more effective if planned in detail. On-target programs that focus on precise and measurable objectives will be successful in meeting the requirements of the standard; unplanned and unfocused programs will not. OSHA, in the Voluntary Training Guidelines, defines three elements of a learning objective:

- Performance must be observable. Employees must be able to *demonstrate* what they have learned.
- Performance must be measurable. The objective should define *what constitutes acceptable performance*.
- Conditions in which performance is to occur must be stated. Objectives should describe the *important conditions under which the individual will demonstrate competence*.

The following is an example of an objective that contains all three elements: “Given an MSDS (conditions), workers will point (observable) with 100% accuracy (measurable) to the location of the health hazard information, precautions for safe handling, and first aid information.”

The objective should describe the desired practice or skill and its observable behavior in sufficient detail to allow other qualified persons or trainers to recognize when the desired behavior has been exhibited. The practical advantage in an industrial situation is that standardized training of equal quality can be presented to all workers in many different locations.

Learning objectives not only provide a road map and define what should be taught. They also act as a means of measurement that allows you to judge whether performance does, or does not, reach the desired goal. The more detailed the objectives, the easier it is for the trainer to “fine tune” the portions of the training that are not effective. Expensive retrofitting of entire programs can be avoided, and a consistent approach adopted by many different trainers.

To familiarize you with learning objectives, ten are listed below. Some meet the three criteria of observable, measurable, and states conditions, and some do not. Remember that “understanding” or “knowing” are internal processes that cannot be measured. Observable

action verbs such as “list” or “point to” are preferable. Can you think what is needed to improve the deficient objectives?

Evaluating Learning Objectives

Do the objectives below contain the three elements of a well-stated objective?		Yes	No
1.	Given an MSDS, employee will correctly locate at least three (3) pieces of designated information..	√	
2.	Worker will understand the hazards of chemicals with which he or she works.		√
3.	Employee will know how to evacuate a work station in the event of a fire.		√
4.	Employee will list correctly the three (3) steps to take in reporting a leak or spill.	√	
5.	Worker will match correctly the names of the three (3) routes of entry with their descriptions.	√	
6.	Worker will have some understanding of the relative hazards of different classes of chemicals.		√
7.	In a true-false quiz, worker will correctly differentiate between the meanings of “acute” and “chronic.”	√	
8.	Employee will learn how to identify hazardous situations.		√
9.	Given a plot-plan of the facility, employee will point correctly to the location of the hazard communication written program.	√	
10.	Following instruction in the ANSI signal words, worker will list in order from “high hazard” to “low hazard” the three (3) signal words “ DANGER ,” “ CAUTION ,” AND “ WARNING .”	√	

You may not have time to write very detailed objectives, but it will certainly pay off in terms of training effectiveness if you devote thought to exactly what you want employees to be able to do. You will also avoid the mistake of buying attractive audiovisual programs that do not meet the site-specific needs of your workplace.

D. How do I put a program together?

Once you know what the learning objectives are, you can plan learning activities. There are several characteristics of hazard communication training to keep in mind. All the trainees are adults, who have different training needs and preferences than children in an educational setting. Within the total group, there may be wide differences in education and job experience, as we discussed earlier. Because we want the knowledge and skills acquired in training to be transferred to the job situation, you need to consider the sequencing of training to match up with job activities as much as possible. You have to make decisions about methods and media,

based on the training needs and resources that you have identified and the objectives that you have defined. Lastly, you must view training as a continuing process, rather than a “one-shot” deal, so that the safe work practices and hazard communication knowledge are maintained on the job. Let’s look at each of these in turn.

1. *Adult Learners.*

Unlike children in school, whose knowledge may not be needed or applied for many years, adults prefer and require training material that is directly relevant to their job and their workplace. For example, it would be inappropriate to give employees a long lecture on theories of toxicology - they want to hear what hazards and possible health effects they should personally be concerned about. They will quickly become “turned off” by teaching material that seems to have no application to them.

We also know that adult learners like to be shown the “big picture” of training goals, before getting into specific details. An overview of the goals of the HCS and the company response will be helpful to their understanding of what is to follow. They also should be informed about the broad outlines of the training plan

Adult learners often have a wealth of life and job experience behind them. They have much to offer to the training session, and an effective trainer will seek their active participation. For example, class members can give instances of “lessons learned” from their experiences of dealing with potentially hazardous chemicals. Useful items of information that emerge in the discussion can be included in future training sessions. In a question and answer session, concerns may be raised that lead to improvements in the hazard communication program or the health and safety program as a whole. Active participation and involvement by employees will help to ensure much better conformance to health and safety practices on the job.

2. *Different Educational and Literacy Levels.*

The educational levels and reading ability of workers can vary greatly from workplace to workplace, and among workers at any given workplace. Many adults may have difficulty reading hazard communication information. In addition to the literacy issue, hazard communication training involves words and concepts that are not familiar to the average worker, and are often new to employers as well.

The challenge for the trainer is to meet the goals of the HCS for people of all levels of education and literacy, even though some of the concepts are not simple. For example, some sections of the MSDS are intended principally for the information of a treating nurse or physician, while others are meaningful to the industrial hygienist or safety professional. It does not help that these documents are not yet in a common format, so that key information looks different and is sometimes located differently in MSDS from varied suppliers. Trainers have developed many ways to address these kinds of issues. Some examples are:

- Providing a glossary of difficult terms that are found on MSDSs and labels. This way, employees do not have to memorize the terms - they can go and look them up.
- Extracting the most important pieces of information from MSDSs and putting them on a single sheet or card in a common format. The cards can be mounted with the MSDS collection in each work area. Such cards for common chemicals or chemical categories are now commercially available. The original documents must, of course, still be available and accessible to employees.
- Preparing mock-ups of common labels, tags, and warning signs and mounting them on a portable easel pad for training purposes.

- Using pictograms to represent types and degrees of hazard, and appropriate personal protective equipment. The Hazardous Materials Information System (HMIS) and National Fire Protection Association (NFPA) rating systems are commonly used.
- Videotaping correct work practices or mock events, and using a “stopping the tape” technique to allow employees to practice putting the actions or events in the correct sequence.
- Taking photos of work sites, signs, operations and people and showing the slides in the training session to make various training points. For example, you can show a fellow worker wearing the correct protective equipment in a hazard area.
- Distributing handouts with pictures and explanations. Pamphlets and handouts of this type are commercially available, or they can be generated in-house.
- Asking experienced bilingual employees to assist in coaching non-English-speaking employees.
- Giving supplementary one-on-one instruction to employees who have difficulty in grasping some of the more difficult concepts.

All of these techniques have been employed effectively for hazard communication training. You may think of others that fit your own particular circumstances and resources.

3. Sequencing of Training

In combination with the prioritization issues that we have previously discussed, the sequence for hazard communication training usually goes as follows:

- General elements - given to all employees identified as being at potential risk. These include: understanding the HCS; understanding MSDSs; understanding labels, and understanding health information. Lesson plans for these can be found in Section III of this document. They also include information on your hazard communication program, the location of the written program, and other facility-specific informational items required by the HCS and listed in Section I, the *Introduction* to this program.
- General elements on chemical categories - given to subsets of employees who work with these categories in their specific work areas. Emphasis will be placed on the most hazardous chemicals and the jobs that are at greatest risk. Lesson plans for some common chemical categories appear in Section III.
- Site-specific training on single chemicals that, although they may fall within a category, have unique hazards or are present in large amounts. Again, some of these chemicals may have a higher priority and require more training time than others. This section will help you address this task of site-specific training, since no packaged program will address hazards and conditions specific to your operations.

4. Selection of Methods and Media.

We know that training is most effective when it simulates the actual job as closely as possible. The closer the simulation, the easier it is for the worker to transfer knowledge and skills to the job.

a. Sequencing training activities.

It is therefore a good idea to arrange the objectives and training activities in a sequence that corresponds to the order in which the tasks are to be performed on the job. For example, if an employee is to learn the process of responding to a hazardous chemical leak or spill, a skill

activity, the proper actions should be taught in the same order. Various training approaches, in order of descending effectiveness, are as follows:

- the real thing (for example, handling a real label or protective equipment)
- a simulation (for example, practicing the handling of simulated chemical spills using water or other harmless agents)
- audiovisual representation (for example, a videotape showing a spill being handled)
- visuals (such as pictures of appropriate protective equipment)
- lectures
- handouts

Handouts appear at the bottom of the list because there is no certainty that they will be studied or even opened when they are the only training approach. As supplements, however, handouts can be very valuable for purposes of reference and reminder. These can be useful tools for all health and safety training.

b. Methods and media options.

Selection of methods depends on the skills and/or knowledge that you are seeking as learning outcomes. Tasks that require group interaction or team response on the job require group-oriented learning activities such as team practice, role playing or small group problem-solving sessions. Tasks that require the individual acquisition of knowledge, such as learning to understand labels or MSDSs, can be taught to the group or by self-paced instruction, such as that provided by computer-assisted instruction. Whatever the method of instruction, the learning activities should be developed in such a way that the employees can clearly demonstrate that they have acquired the desired skills or knowledge. Within the constraints of available resources, selection of methods and media can include the use of:

- lectures and discussions
- small group practice exercises
- individualized instruction via computer or hard copy
- charts and diagrams
- manuals, containing a summary of the material and a glossary or reference materials
- slides, either purchased or taken at your facility
- overhead transparencies, which can be prepared ahead of time or used as blank areas to record examples and suggestions from the group
- PowerPoint slides, which can be used in the same way
- videos, either purchased or home-made, to supplement instruction
- a chalkboard or easel pads, to list key points or to record discussion points and questions
- handouts.

Each of these methods and media have their own advantages and disadvantages, and are appropriate for different purposes. A survey of chemical manufacturers found that audiovisual aids such as videos and overhead transparencies, and on-the-job training were most commonly used, but the audiovisual aids were most probably accompanied by some type of lecture. Small

companies usually cannot afford sophisticated training aids, and the “trainer” is someone who wears many hats. However, many small companies have managed to conduct effective hazard communication training by using several different strategies. These include:

- “piggybacking” segments of HCS training on regularly scheduled safety meetings.
- selecting one or more employees, usually supervisors, to be the “trainers”, and making them responsible for the training after attending a “train-the-trainer” course.
- developing home-made training aids, using slides or videos, to depict actual scenes of employees in the workplace and pictures of MSDSs and labels.
- sending employees off-site to locally offered courses for training in the general elements.
- combining HCS training with other courses required by regulations. For example, some basic elements of the OSHA HAZWOPER standard (29 CFR 1910.120) overlap with hazard communication, and it is possible to satisfy parts of both requirements at the same time. This also is helpful to the employees, since both refer to the same chemical hazards.
- using free or low cost training materials made available through trade associations, unions, OSHA, and other sources.

These ideas have, in many cases, resulted in training programs that are equally as good as, and sometimes more effective than, expensive programs that do not meet the site-specific requirements of the HCS.

A brief summary of the pros and cons of common methods and media follows:

Methods and Media - Pros and Cons

<u>Method</u>	<u>Pros</u>	<u>Cons</u>
Lecture	<ul style="list-style-type: none"> Can cover lots of information Used with large and small groups Total control of information by lecturer 	<ul style="list-style-type: none"> Doesn't encourage participation One-way communication limits understanding of learner needs Inappropriate for teaching skills No way of measuring whether learners comprehend
Discussion	<ul style="list-style-type: none"> Involves learners actively Instructor gets valuable feedback on learner needs Learners can discover new concepts Learning climate is more relaxed 	<ul style="list-style-type: none"> Can go off on tangents Requires skill in maintaining class control Open-ended questions must be carefully structured for discovery to occur Extra instructor assistance is needed to help when class is broken down into small groups
Demos	<ul style="list-style-type: none"> Relates information to the real world 	<ul style="list-style-type: none"> Requires thorough preparation

<u>Method</u>	<u>Pros</u>	<u>Cons</u>
	<p>Attention-getting. Can be geared to learners' capabilities</p> <p>Excellent for skills training when accompanied by learner practice</p>	<p>Should be limited to small groups or one-on-one (Closed circuit TV can be used for some demonstrations)</p>
Small group activities	<p>Can be used to break up large groups</p> <p>Builds group rapport</p> <p>Excellent opportunity to apply new knowledge</p> <p>Can simulate many real-world problems/situations</p>	<p>Practice activities must be structured in detail</p> <p>Dominant personalities may overwhelm less aggressive</p> <p>Group size may be restrictive - should be limited to 3-7 learners per small group</p>
Independent study, Computer Assisted Instruction, Interactive Video, Distance Learning	<p>Learners can proceed at their own speed</p> <p>Learner gets feedback on level of mastery</p> <p>Eliminates negative peer pressure</p> <p>CAI can be remote, yet connected to a central source</p> <p>Can interact without a keyboard</p> <p>CD-ROM adds realistic pictures and movement</p> <p>Employees increasingly familiar with computers</p>	<p>Highly dependent on quality of media used</p> <p>Absence of human interaction</p> <p>More effective for teaching knowledge than teaching skills</p> <p>Hardware/software can become outdated quickly</p> <p>Requires extensive development time</p> <p>Requires computer literacy</p>

<u>Media</u>	<u>Pros</u>	<u>Cons</u>
Overhead Transparencies	<p>Very versatile</p> <p>Easy to produce on copy machine</p> <p>Simple to control and operate, inexpensive</p>	<p>Are large; require storage arrangements</p> <p>Information must be brief, or will be too difficult to read</p>
35mm Slides	<p>Easily handled and stored</p> <p>Flexible, adaptable</p> <p>Can be combined with taped narration for repeatability</p>	<p>Loose slides easily disorganized</p> <p>Requires photographic skills</p> <p>Commercially available programs not always relevant to your operations</p>

<u>Media</u>	Pros	Cons
Power Point/ Computer Projection	Extremely versatile –all Advantages of 35mm slides Can be easily modified/adapted Can be used in conjunction with distance learning	Requires computer literacy Equipment can be expensive initially <hr/> Image display limited to size of monitor
Videos	<hr/> Permits same image to be played to large numbers of people at many locations Can be shot in-house to reflect site-specific operations	Equipment standards not uniform worldwide Commercially available programs not always relevant
Blackboard, Chart Pad	Flexible for controlling discussion Excellent for emphasis Inexpensive	Not good for complicated topics Not good for keeping permanent records Possible loss of consistency from one group to the next

c. Purchased programs.

You may decide to purchase training programs to supplement your hazard communication training. If so, you should ask yourself the following questions:

- Does this program meet precisely the needs I have identified?
- If not, is there some built-in flexibility that will allow me to make appropriate modifications?
- Could it be used to supplement what I already have, or for retraining?
- Are there some data I can see that indicate that this program has been effective with groups of workers similar to these?
- Is the vendor willing to give me names of previous clients, so that I can find out what they think of its effectiveness?
- Can I preview all or part of the program?
- Is there a Lesson Plan or Leader's Guide that will help me to administer the program?
- Are there manuals or handouts for the employees that will help them to remember and apply the knowledge and/or skills?
- Are there tests or quizzes that will help me to document our employees' understanding of the content of the program?

d. Combining methods and media.

Effective programs generally combine methods and media. Let's look at **George Foster** again. He has prioritized his hazard communication training activities, and knows who has to be trained about what. Since we saw him, he has assessed the training task, the characteristics of his employee population, and the resources available to him. He has prepared some simple learning objectives, and now has to make some decisions about methods and media. Once his decisions are made, he writes brief notes to himself to keep himself on track with each instructional session. His decisions are as follows:

- *20 employees are given training on the General Elements. George uses **standardized Lesson Plans** (see Section III), supplemented with **overhead transparencies** made on the copy machine. He plans to acquire equipment eventually that will allow him to show the same information in the form of computer-generated PowerPoint slides. He also shows a commercially available **video** on the HCS, and distributes a **pamphlet** that came with the video, containing the facts about the HCS. George makes notes to himself to incorporate information unique to his operation into the training session, such as the location of the inventory, MSDSs, and written program. He encourages **discussion** from the employees, and responds to their concerns. The training is conducted in several 20-minute sessions during new employee orientation.*
- *Area A employees receive training on the chemical category "flammables." George uses a **standardized Lesson Plan** for this, but adds details pertinent to Area A operations. For the two chemicals with different properties, he shows the individual MSDSs as **overhead transparencies** for discussion purposes. He prepares a simple **handout** containing the objectives of the training, a summary of the information on flammables, and copies of the MSDSs. He includes the three maintenance people from Area B in this training session, since they are likely to encounter all hazards.*
- *Area B employees receive training on the site-specific hazards in their area in the same way as Area A.*
- *The three maintenance people also attend this session. However, George then takes the opportunity to spend extra time with the three employees with maintenance duties, to make sure that they have the "big picture" of all the potential hazards in the facility.*
- *George documents all training, and realizes that he must follow up to check if employees have transferred their hazard communication knowledge and skills to the job.*

Although George Foster's approach is simple and low cost, it is just as effective as programs using more expensive methods and media. It is probably more effective than generic "one-shot" training programs that do not target site-specific needs.

e. Summary

A table that summarizes the steps that lead to the selection of appropriate methods and media follows.

Summary of Steps in Methods and Media Selection

- | |
|---|
| <ol style="list-style-type: none">1. <i>Define the resources:</i> Note any limiting conditions for both development and implementation of the training program in terms of time, costs and resources available. |
|---|

2. *Define the size of the group:* Decide whether you will have to conduct individual, small group or large group instruction.
3. *Define population characteristics:* Note educational levels, language preferences, and other considerations.
4. *Define task characteristics:* Note the types of desired learning outcomes.
5. *List the learning objectives* for the types of learning that you have defined.
6. *Arrange the objectives in the desired sequence* to simulate the job as closely as possible.
7. *List the methods/media options* from which a choice is to be made, and check the advantages and disadvantages of each.
8. *Make final methods/media choices.*
9. *Write guidelines to the instructor* for presenting the unit of instruction, including notes on instructional events, such as discussion sessions.
10. *Write brief guidelines for the students* if necessary, to assist them in using the media correctly; for example for computer-assisted instruction.

E. How do I conduct the training?

The following basic steps apply to the most common situation, where the trainer has limited time and resources, as well as to situations where high technology solutions are available. The first major activity involved in conducting training is preparation, which is essential to effective training. This includes the general preparation you need to make decisions about such things as the layout of the training room and the elimination of distractions, to the preparation of equipment and written materials. Following preparation, there are several steps involved in actually conducting the training.

1. General Preparation.

The general preparation factors that should be considered for training that will take place in a classroom setting are:

- **Physical layout.** The training room should be large enough to accommodate comfortably the number of trainees expected plus the needed equipment and furniture. Effectiveness of instruction can be reduced by overcrowding. The shape of the room also can affect the acoustics, visibility, and the nature of the group interaction. Low ceilings with obstructions such as hanging lights are to be avoided; high ceilings (12 feet) are preferable, particularly when images are to be projected on a screen.
- **Physical conditions.** Extremes of heat or cold and poor ventilation interfere with learning efficiency. High temperatures and humidity cause drowsiness; cold causes discomfort. The instructor should know where the controls are and how to operate them. Similarly, a poorly lit facility interferes with the readability of display surfaces and printed training materials, and can cause stress and fatigue. The learning process is also made more difficult if there are sources of disruption and distraction, such as announcements on a public address system. Using a cafeteria or public room may involve constant interruptions. In these cases, it may be better to arrange for other facilities.

- Seating arrangements. The choice of seating arrangements will depend on the type of training session selected, the number of participants, the space available, and the learning objectives to be achieved. The way in which employees are seated will influence the degree of control the instructor has over the group, the level of interaction between the instructor and individual participants, and interaction between the participants. For example, a U-shape, V-shape or half-circle arrangement will tend to encourage group interactions because participants have eye contact with each other. A formal classroom setup will tend to discourage group interactions because everyone will be facing the instructor.

2. Specific Preparation.

Everyone who has conducted training has had the experience of having to deal with burned-out bulbs, a shortage of electrical outlets, and other unplanned training “glitches.” These unpleasant experiences can be minimized by the use of a good checklist. Following is a suggested training room checklist.

Training Room Checklist

Physical layout:			
seating arrangement	___	acoustics	___
illumination control	___	doors and exits	___
other	___		
Furniture:			
chairs	___	tables	___
lectern	___	displays	___
other	___		
Projection equipment:			
overhead projector	___	remote controls	___
slide projector	___	screen(s)	___
computer/computer projector	___		
extra carousels	___	spare bulbs	___
video playback	___	other	___
window shading	___		
Display writing surfaces:			
easels	___	pads	___
chalkboard	___	wall space	___
blank transparencies for overhead projection	___	other	___
Supplies:			

note pads	___	pens	___
pointer	___	paper clips	___
masking tape	___	chalk	___
markers for		other	___
transparencies	___		
Training materials:			
lesson plans	___	handouts	___
copies of quizzes	___	participant roster	___
training certificates	___	other	___
Pre-function check:			
equipment operational	___	wiring covered/	
help resources (such as		taped	___
electrician) identified	___	room key obtained	___
		other	___

3. Conducting Training.

How you conduct training will, of course, depend upon the initial assessment of needs and the population and resource considerations that you have identified. Most hazard communication training will be addressed to issues specific to each workplace and will be conducted at the local level with small groups of employees. Time is usually available only in “chunks” of not more than 40 minutes, or the time normally devoted to a regular safety meeting. In any circumstances, the four activities involved in conducting training are overview, presentation, application, and practice or review.

a. Overview.

The overview is important to the adult learner. It should be designed to present the big picture into which the hazard communication training fits, and to present needed information to bring all trainees up to speed on your hazard communication program as a whole. For example, in introducing a session on methods and observations for detecting hazardous conditions, the instructor might spend a few minutes describing how this segment of training fits into the company hazard communication program as a whole.

The overview should also emphasize the importance and relevance of the material to be discussed. It should place the session in relation to past and future sessions and state clearly the expected learning outcomes. Examples related to the job experience of the employees will reinforce the message that the hazard communication training is job-related and important. Approximately 10% of the time available for short training sessions should be devoted to the overview.

b. Presentation.

When presenting material, it is best to start with known or simple information and proceed to the more complex facts. This should be done in small steps. Each step in the process should relate to the whole picture as well as to the other steps. Key points should be emphasized and demonstrations and visual aids used as appropriate. Active participation should also be

encouraged and praised by the instructor. As stated in the OSHA Voluntary Training Guidelines, “Employees can become involved in the training process by participating in discussions, asking questions, contributing their knowledge and expertise, learning through hands-on experience, and through role-playing exercises.” Using a variety of methods and media will also help employees retain information.

c. Application

The application step, most clearly defined in skills learning, gives the learner the opportunity to perform the skills in a supervised situation. For example, in a session on reporting on a leak or spill, the instructor’s live demonstration of following a sequence of actions would be followed by an opportunity for the trainees to perform the sequence in the correct order. Another type of application exercise is to divide the class into small groups and to assign hazard communication-related problems for the groups to solve. Solutions to the problems should be based on the experience of the employees as well as on the material presented in the class. Errors can be checked and corrected and positive responses developed and praised in this context. Encouraging and positive comments by the instructor will spur the employees on to mastery of the knowledge or skill. Application activities relate the classroom instruction to the job and actively involve the employees in the acquisition of new knowledge and skills, as recommended by the Training Guidelines.

d. Review and practice.

Unlike a school setting, where there are study periods, instruction in the workplace does not give employees time to review their notes or assimilate what they have learned. Generally, they leave the training session and go straight back to work. This means that the instructor has to build in the review throughout the instructional sequence. If there are 5 major instructional objectives, for example, review is needed following each of the five course segments, as well as at the end. This is particularly critical in hazard communication training, which may contain many unfamiliar words and concepts. Cumulative review is necessary if the objectives represent building blocks that lead towards the desired new knowledge or skills. For example, if the idea of adverse health effects resulting from overexposure to a hazardous chemical is built on knowledge of routes of entry and acute versus chronic effects, review items should not be independent of each other. They should include the earlier concepts and show how they relate. Some ways to use review to help cement in new knowledge and to relate it to previously learned material are:

- pair employees off, and ask them to observe and critique each other’s performance at knowledge or skill tasks.
- if videotapes are used, stop the tape at important points for purposes of review and discussion.
- stop and ask questions at key points in a presentation.
- employ a review “game” with small-group teams.
- summarize the main points, and relate them to a real-life example of activities in the workplace.

F. How do I evaluate program effectiveness?

Many instructors think that they are through with their hazard communication training when they are finished with the training sessions. However, it is extremely important to gain an idea of whether the program is effective. It is more important where the HCS is concerned than for any other standard, since it is a “performance” standard. Program effectiveness is judged by

whether it achieves its objectives and actually works. The information that you will gain from evaluation will be very useful, since you will be able to make changes that continually improve the effectiveness of the training. As a simple example of an easy-to-measure objective, either the employees will know where the emergency shower is, or they will not. Similarly, either employees will be able to follow correct evacuation procedures or they will not, and either they will be able to locate important information on the MSDS or they will not. Without an evaluation, you cannot know if training has been successful or has been completely off-target, nor will you know how to correct any problems.

Generally, evaluations are either *formative* or *summative*. Formative evaluations measure success during or immediately following training development and implementation; they tell the instructor what needs to be done immediately to improve the training. Summative evaluations measure whether the knowledge or skills have transferred to the job and other long-term results.

Questions answered by evaluations include:

- Have I achieved the objectives of the training program, in terms of the immediate acquisition of knowledge or skills during class?
- Do observations in the workplace show that the desired changes in knowledge and skills have been transferred to the job?
- Can the positive changes, or lack of changes, be the result of the instructional program?
- Is it likely that similar changes will occur for other employees taking this program in the future?
- What can I do to improve the training program and make it more effective?

These are the five commonly used types of evaluations:

1. Participant Satisfaction (formative).

The participant satisfaction type of evaluation, such as opinion ratings of the training, is subjective. It is the easiest to conduct, but does not tell you what learning has occurred. It can, however, yield important information. Questions on the appropriateness of the training materials, the time taken to cover certain points, or the distractions of noise around the training room can reveal surprising answers and unanticipated problems. For example, if employees rate your presentation on chronic health effects as “too fast” or “too difficult to understand,” another simpler approach emphasizing only the key points should be considered, or more time allocated.

2. Learning Outcomes (formative).

True/false tests and other quizzes are typical of the kind of measures that are given immediately following the training. They reveal how well employees have learned principles, skills, and other information. The test items are based on the learning objectives that were initially defined. For example, the objective “Given an MSDS, worker will point with 100% accuracy to the location of the safe handling precautions” would be turned into the test item: “Point to the safe handling information on this MSDS.” Methods for measuring learning outcomes include paper and pencil or oral test items, job simulations, or any other activity that directly reflects the learning objectives. **It is important to note that the items do not measure the learning abilities, or lack of abilities, of the employees. They measure the effectiveness of the program and the skill of the instructor. They are used only to upgrade and improve the program.** This point should be emphasized to employees, who may feel that poor performance on a quiz will somehow affect promotional opportunities.

3. *Attitude Changes (summative).*

Attitude changes are generally measured by questions, surveys, interviews and observations. If the hazard communication training has been cooperative and encouraging, so that employees feel that the training has been a useful and positive experience, changes may be seen in their willingness to apply the new knowledge and skills on the job. Poor communication or discouragement of employee involvement in the hazard communication program may result in negative feelings and attitudes. Employee attitudes – their feelings about their job, their supervisor, and their workplace – directly affect behavior and can have a significant effect on performance. In turn, positive changes in behavior, such as the outcomes of effective instruction on working safely around hazardous chemicals, will result in more positive attitudes.

4. *Job Performance Changes (summative).*

Evaluations of job performance changes attempt to determine whether the employee has transferred new knowledge or skills acquired in the classroom to the work setting. This is important for all health and safety training, including hazard communication, since the goal is to have zero errors on the job. Methods include: observations of work practices; analysis of usage of required equipment, such as PPE; measurable results of specific training objectives; review of safety records before and after training; and comments from employees and supervisors describing significant changes in hazard communication-related behaviors.

5. *Accomplishment of Organizational Goals (summative).*

Although the primary goal of all health and safety training is protection of the worker, it is generally recognized that the organization also benefits greatly when the employees are knowledgeable about potential hazards in the workplace and have learned to work safely. Since every illness and injury has a direct effect on productivity and profitability, a reduction in such illnesses will have a significant effect. For example, the financial consequences of an acute overexposure of several employees to a toxic substance, or of chronic ill-health resulting from long-term repeated exposures, can be extremely severe. Achievement of organizational goals generally, or hazard communication goals in particular, is not easily attributable to training alone. However, as a key component of a successful hazard communication program, training should be given credit for much of the achievement.

G. *What do I do with evaluation results?*

1. *Using Evaluation Results to Improve the Training.*

A good evaluation will show exactly how your hazard communication training program needs to be improved. It will be clear that either the desired knowledge and skills have been achieved, or they have not. If some of the learning objectives have not been satisfied, the program must be revised and improved until they are achieved. Typically, you will be able to identify “weak spots” by the failure of most of the employees to answer correctly in a quiz. Sometimes, you will get feedback from participants’ comments that will surprise you; concepts that are familiar to you may have been confusing to the employees. If the steps in the training process have been followed systematically, it is relatively simple to retrace the route to identify where improvements are needed.

A common mistake is to add more elaborate explanations where weak spots have been found, in an attempt to correct shortcomings in the program. Often, the deficiency is due to a lack of clarity rather than a shortage of explanation. Instead of adding more details and possibly increasing the confusion, the solution may be to restructure and simplify the materials, or link them in a more solid way to previously-taught concepts. Some initial objectives may have to be reexamined because they do not contribute to the goal of protecting employees. For example,

the objective of teaching employees to spell terms such as “mutagenicity” may be redundant to the goal of training them to avoid contact with certain chemicals that are suspected mutagens. Another common error is to retain material in the course that is already known to employees because it has been covered in other training, and therefore could be omitted or simply linked to the prior training as a refresher item.

It is tempting to consider the hazard communication training as finished once your evaluation shows that it is effective. This is particularly true when a standard such as the HCS contains no specific requirement for retraining. However, the HCS, as a performance standard, requires that training be effective - all the time. Apart from the natural process of forgetting, changes in workplace procedures and practices and the introduction of new chemicals make it vital to maintain the training as a dynamic and ongoing process. Training should be reinforced constantly with reminders by supervisory personnel and with brief reviews during regularly-scheduled safety meetings, posters, hard-hat decals, handouts, and other methods. The knowledge and skills taught in the classroom should become habitual components of standard work practices.

Let's return to **George Foster**, who has now done his hazard communication training, following the plan outlined earlier. George gathered participants' comments on the training, and also administered a simple hazard communication quiz, and found the following:

- *The handouts seemed to take participants' attention away from points that George was making. Employees were examining the handouts instead of focusing on the points being made.*

Solution: *give out the handouts at the end, and use them as a review mechanism.*

- *Employees in the back were not participating - one fell asleep.*

Solution: *make sure to include those employees in the discussion by asking questions about their experiences on the job.*

- *The majority of the participants had real problems with one item on the quiz relating to the terms “TLV” and “TWA” on the MSDS.*

Solution: *George decided to put together a simple glossary of technical terms found in MSDSs.*

- *Several employees asked questions about potential exposures to hazardous chemicals through their home activities and hobbies.*

Solution: *George was pleased to get these questions, which showed real interest. He was able to obtain pamphlets on safety in the home through the local Safety Council.*

- *The training for Area A and Area B employees on site-specific hazards seemed to go well, and the immediate test results were good. However, when George followed up by observing activities on the job, he saw that the proper gloves were not being worn by one employee.*

Solution: *George found that there had been a misunderstanding, and gave one-on-one help to this employee. He continues to follow up.*

This example illustrates some of the things that can be done to evaluate and improve a hazard communication training program. Every workplace is unique, and the problems and solutions will vary widely.

2. Retraining Issues.

The HCS, as a performance standard, has no specific retraining requirement. However, the name “performance” means that you should retrain when you find that employees are no longer retaining their hazard communication knowledge and skills. You may find that you need to retrain frequently to maintain the effectiveness of the program.

Retraining needs are often misunderstood - some employers think that they have to repeat the entire hazard communication training program. This may not be the case. Your evaluation results will be helpful in determining exactly how much retraining is needed. If you can document through evaluation measures that some or most knowledge and skill concepts have been retained, then there is no need to repeat those parts of the hazard communication training program. For example, if employees can tell you where the hazard communication written program is located, there is no need to repeat the information. Similarly, if they can satisfy your objectives that they know “methods and observations” that may be used to detect the presence or release of a hazardous chemical in the work area, there is no need to repeat the training program. This means that you have to keep following up on, and documenting, the effectiveness of the training program by observing employees on the job and reminding them about what they have learned.

3. Documentation.

The issue of retraining leads directly to the importance of documentation. Although documentation of training is not required under the HCS, it can be very useful for assuring that all employees receive the training they need.

Let’s look again at **George Foster** and the hazard communication training that he has implemented at his facility. Although he did not use sophisticated training methods and media, it is apparent that he devoted considerable time and resources to developing, presenting, evaluating, and improving the training. At a minimum, George should document:

- *title of lesson.*
- *date of presentation.*
- *learning objectives.*
- *training program outline.*
- *names of participants, with an identifier such as Social Security number.*
- *names of instructors.*
- *data, such as test results, to demonstrate that objectives were met.*

Paper copies of training records are hard to maintain, since employees have to be tracked from job to job within a company or facility. New training should be documented when new processes or new chemicals are introduced. Fortunately, it is now possible to purchase inexpensive and user-friendly software from sources such as the National Safety Council that tracks courses, employees, and instructors. The sign-up sheets from each training session can also be retained for direct documentation. Whatever method you select, make sure that you maintain documentation for all hazard communication training.

H. Summary

In this section of the Model Training Program, we have described the steps that will assist you in developing and implementing an effective hazard communication training program at your facility. The steps are:

- Prioritizing HCS information and training needs.
- Identifying training needs.
- Preparing training goals and objectives.
- Developing learning activities.
- Conducting training.
- Evaluating program effectiveness.
- Improving programs continuously.

In the next section, Section III, you will find Lesson Plans that will be helpful in offering training on general elements that are common to all employees who fall under the HCS, and also on some common chemical categories

III. GENERAL ELEMENTS

A. Introduction

In the previous section, we explained how to develop and run an effective hazard communication training program. In this section, you will find a series of instructor Lesson Plans. You saw with the example of George Foster how the plans can be incorporated into your overall hazard communication training program. They are generic, and you will probably want to adapt them to reflect the details of your workplace and your hazard communication program.

The first four Lesson Plans cover topics that are common to all employees who fall under the HCS. The information is “portable,” and can be carried from one work site where there are hazardous chemicals to any other.

The remainder deal with categories of chemicals. Under the HCS, you are allowed to instruct about categories, such as flammables, as long as you communicate about any uniquely hazardous properties of chemicals within the category. These Lesson Plans should be useful if you have groups of employees who are potentially exposed to several flammables or several chemicals in the other categories.

The four chemical categories represent one way of grouping chemical hazards; you may prefer another. “Toxic Chemicals,” the last category, represents any substance whose main hazard characteristic is toxicity. Any of the substances that fall into the “Flammables and Combustibles,” “Corrosives,” and “Reactive Chemicals” groups can also be toxic. However, the main hazard characteristics in these groups are fire, chemical damage to living tissues, and reactivity, respectively.

The Lesson Plans are:

General Elements for All Employees

- A. Understanding the Hazard Communication Standard
- B. Understanding the Material Safety Data Sheet
- C. Understanding Labels
- D. Understanding Health Information

General Elements - Chemical Information

- E. Flammables and Combustibles
- F. Corrosives
- G. Reactive Chemicals
- H. Toxic Chemicals

B. How to Use the Lesson Plans

The first page of each Lesson Plan lists the lesson title; the intended audience; any prerequisites; the approximate time required; materials and equipment needed, and learning objectives. The format is outlined below.

Lesson A: Understanding the Hazard Communication Standard

Lesson Title:	
Intended Audience:	
Prerequisite:	
Time Required:	
<i>Materials and Equipment Needed</i>	<i>Learning Objectives</i>

Lesson Title:

- Title of subject covered.

Intended Audience:

- Audience to whom lesson is geared (e.g., managers, at-risk workers, general employee population).

Prerequisites:

- Knowledge, skills or other instruction that trainees should have attained before participating in this lesson.

Time Required:

- Approximate time to complete lesson. This can vary widely, according to group size, additions that you may wish to make, and time available.

The second and subsequent pages of the Lesson Plans are **Lesson Plan Worksheets**. They are formatted to show the title of the lesson; the estimated time for covering each point; the subject outline; suggestions to the instructor on “What to Do” to teach about each item; and a column listing aids or cues for each item, such as “Slide Number 1.”

A sample format follows:

Time	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> : yourself <u>Circulate</u> attendance sheet	Slide No. 1: Title Slide

As you review the Lesson Plans, you will notice that the “What to Do” column contains action verbs underlined, such as discuss, describe, and list. Following these verbs are suggested explanations, descriptions and discussion points.

For every Lesson Plan there are choices on how to show slides. Slides can be **projected in PowerPoint** if you have a laptop computer and projection equipment. Or, they can be run off as paper copies that can be assembled and distributed as a **handout**. A third choice is to make them into **overhead slides** that can be reproduced on acetate to be shown as overhead

transparencies, using an overhead projector. The slides are numbered; these numbers are indicated at the appropriate points in the “Aids/Cue” column as you proceed through the lesson. If you prefer, you can make your own slides, either in PowerPoint, or by typing them and copying on acetate, or by drawing directly on acetate. Whichever slide option you choose, you can always reinforce learning and make the training more effective by creating stapled paper handouts for employees. If Distance Learning technology is applied to these lessons, the slides can be made accessible to each employee as part of the lesson.

Finally, every Lesson Plan ends with a brief **quiz**. This can be reproduced and handed out at the end of class, or can be conducted orally for employees who have reading or language difficulties. Remember -- this is not a “test” of employee abilities. You can allow employees to refer to their handouts while responding to the quiz if you like -- your goal is to reinforce learning of the key points you have covered in class. If you add further objectives to the Lesson Plan, or wish to change objectives, make sure that these changes are reflected in the quiz. We suggest that you document the results of the quiz, and give extra help to employees who have difficulty with some of the items.

C. Preparation for Training

We suggest that you familiarize yourself thoroughly with each Lesson Plan prior to instruction. Make any changes that you wish; for example, you may want to show a commercially-available video that you have acquired, to give an overview or cover some special point. Also make sure that you have all the proper equipment and materials listed in the Lesson Plan. If you plan to use computer-projected slides or add videos, consider the following factors:

- Are you familiar with the technical operation of the computer, projector, or VCR?
- Will all participants be able to see the screen and/or hear the video? For a large group, two monitors may be necessary.
- Is the room conducive to viewing slides or a video? Can it be darkened? Is there an adequate source of electrical power?

Other preparation points were covered in the previous section of the Model Training Program. As a reminder, training is best conducted in an area removed from plant noise and distractions, with good lighting and comfortable chairs. If you wish to promote discussion and participation, arrange the chairs so that participants can have eye contact with each other as well as with the instructor.

We also discussed some of the features of adult learning in the previous discussion. In summary:

- Adults learn what they feel a need to learn. You should let them know what the knowledge can do for them.
- Adults learn best when they need the knowledge now, and not some time in the distant future. Try to relate to current concerns on the job. Cut the theories and get to practical application.
- Adults relate their learning to what they already know. If the new knowledge doesn't fit in with their experience, they will have difficulty accepting it. On the other hand, their experience can be valuable to the instructor as a rich source of examples.
- Adults learn best in an informal environment. They dislike being treated like school children. Ask them to let you know if the discussion moves away from areas that interest them.

- Adults respond to a variety of teaching methods. If you can, avoid a straight lecture format. Encourage discussion and participation.
- Adults like to know how they are doing. They need reassurance that they are on the right track. Use sincere praise and guidance.

As you or other instructors become familiar with the Lesson Plans, you will see more ways to improve them and to adapt them to your own circumstances. We encourage you to do so. You can also use them as a model to write some of your own. Your Lesson Plans will become part of the documentation that you keep in the hazard communication written program to demonstrate your compliance with the employee information and training requirements of the HCS.

APPENDIX A

GLOSSARY OF TERMS COMMONLY USED ON MSDSs AND LABELS

A

Absolute Gravity - Refers to the density or specific gravity of a fluid at standard conditions; for example, with gases, at 760 mm Hg (pressure) and 0 degrees Centigrade (temperature). Also known as absolute density.

ACGIH - American Conference of Governmental Industrial Hygienists: an organization of professional personnel in governmental agencies or educational institutions engaged in occupational safety and health programs. ACGIH develops and publishes recommended occupational exposure limits (see "TLV") for hundreds of chemical substances and physical agents.

Acid - A compound which dissociates in water to form an anion and a hydronium ion. An acid reacts with a base or alkali to form a salt and water. An acid turns litmus paper to red.

Acute Effect - An adverse effect on a human or animal, with symptoms developing rapidly and coming quickly to crisis. Usually occurs following a single exposure to a chemical. Also see "chronic effect."

Acute Toxicity - The adverse (acute) effects resulting from a single dose of, or short exposure to, a substance.

Aerosol - An airborne solid or liquid substance.

Alkali - A compound that has the ability to neutralize an acid to form a salt. A substance that is bitter in a water solution, and somewhat irritating or corrosive to the skin, eyes, and mucous membranes. This type of substance turns litmus paper to blue. Common strong alkalis are sodium and potassium hydroxide. Also known as "base."

Allergic Reaction - An abnormal physiologic response to a chemical or physical stimuli by a sensitive person. Some dermatitis and asthma-like symptoms result from allergic reactions.

Anesthetic Effect - The temporary loss of feeling induced by certain chemical agents, which reduce the ability to feel pain or other sensations. For example, hydrogen sulfide

has an anesthetic effect on the olfactory nerve and thus reduces one's ability to smell the gas.

ANSI - American National Standards Institute. A private, nonprofit organization founded in 1918, it is the coordinator of voluntary standards activities in the United States. ANSI has issued voluntary guidelines for MSDS and labels.

APR - Air purifying respirators. These respirators remove contaminants by passing breathing air through a purifying element. There are two subclasses; (1) particulate APRs which use a mechanical filter element and (2) gas and vapor APRs which utilize chemical sorbents contained in a cartridge or canister.

Asphyxiant - A vapor or gas that can cause unconsciousness or death by suffocation (lack of oxygen). "Simple asphyxiants" are those asphyxiants which are harmful to the body only when they become so concentrated that they reduce oxygen in the air (normally about 21 percent) to dangerous levels (19.5 percent or less). Asphyxiation is one of the principal potential hazards of working in confined spaces. See "chemical asphyxiant."

Aspiration Hazard - The danger of drawing a fluid into the lungs and causing an inflammatory response to occur.

Autoignition Temperature - The lowest temperature at which a flammable gas or vapor-air mixture will spontaneously ignite without spark or flame. Vapors and gases will spontaneously ignite at a lower temperature in oxygen than in air. The autoignition temperature may also be influenced by the presence of catalytic substances.

B

Barrier Cream - See "protective cream."

Base - See "Alkali."

Blasting Agents - DOT (the U.S. Department of Transportation) Hazard Classification applied to those substances which have probability of accidental initiation owing to explosion or probability of transition from deflagration to detonation.

Boiling Point - The temperature at which a liquid changes to a vapor state, at a given pressure; usually expressed in degrees Fahrenheit at sea level pressure (760 mm Hg. or one atmosphere).

C

C, or Ceiling - The maximum allowable human exposure limit for an airborne substance; not to be exceeded, even momentarily. Also see "PEL" and "TLV."

Carbon Monoxide - A chemical asphyxiant: a colorless, practically odorless, flammable, and very toxic gas produced by the incomplete combustion of carbon compounds. Also a by-product of many chemical processes.

Carcinogen - A substance capable of causing or producing cancer.

C.A.S. - Chemical Abstracts Service: an organization operated by the American Chemical Society that indexes information published in "Chemical Abstracts" and provides index guides by which information about particular substances may be located in the Abstracts. C.A.S. Numbers - Identify specific chemicals.

Centigrade - (C) Also Celsius, the temperature scale in which there are 100 degrees between the freezing point (0 degree C) and the boiling point (100 degrees C) of water.

CFR - Code of Federal Regulations; the standards, regulations, and rules promulgated under U.S. law and published in the Federal Register.

Chemical Asphyxiant - Substances that prevent the body from receiving or using an adequate oxygen supply. Carbon monoxide and cyanide are examples.

Chemical Family - A group of compounds with related chemical and physical properties. Example: acetone, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK) are three members of the "ketone" family.

Chemical Pneumonitis - Inflammation of the lungs, caused by accumulation of lung liquids following chemical irritation. See "aspiration hazard."

CHEMTREC - Chemical Transportation Emergency Center: a national center established by the Chemical Manufacturers Association (now the American Chemistry Council) to relay emergency information concerning specific chemicals that have been involved in a transportation emergency.

Chronic Effect - An adverse effect on a human or animal in which symptoms develop slowly following repeated, normally low level exposures to a chemical over a long period of time, or recur frequently.

Chronic Toxicity - Adverse (chronic) effects resulting from repeated doses of, or exposures to, a substance over a prolonged period of time.

CNS - Central nervous system, composed of the brain and spinal cord.

CNS Depression - Lowered sensitivity level or loss of sensation in the central nervous system, usually due to exposure to a particular chemical hazard or anesthetic.

CO₂ - Carbon dioxide; a colorless, nonflammable, and relatively nontoxic gas. Is produced by the combustion and decomposition of organic substances and as a by-product of many chemical processes. A simple asphyxiant at high concentrations.

COC - Cleveland Open Cup; a flash-point test method.

Cocarcinogen - Material that potentiates the effect of a carcinogen in the production of cancer. See also "carcinogen."

Coma - A state of deep unconsciousness from which one cannot be aroused, even by powerful stimulation.

Combustible - A substance capable of fueling a fire. Also a term used to classify certain liquids on the basis of their flash points. Also see "flammable."

Combustible Liquid - As defined by the Department of Transportation, it is any liquid having a flash point, as determined by a closed-cup method, equal to or greater than 100 degrees F and below 200 degrees F.

Concentration - The amount of a substance in a stated unit of a mixture or solution. Example: 2 parts per million hydrogen sulfide in air, or a 50 percent caustic solution.

Contaminated - The presence of any extraneous material that may render a substance, a material (such as clothing), or a surface (such as skin) impure.

Corneal/Conjunctival Burns - Burns to the transparent membrane covering the eyeball and lining the eyelids.

Corrosive; Corrosive Material - As defined by the Department of Transportation, a corrosive material is a liquid or solid that causes visible destruction or irreversible alterations in human skin (tissue) at the site of contact; or, in case of leakage from its packaging, a liquid that has a severe corrosion rate on steel.

D

Decomposition - Breakdown of a material or substance (by heat, chemical reaction, electrolysis, decay, or other processes) into simpler substances.

Dehydrating Agent - A substance capable of depleting body fluids or removing moisture from another material.

Dermal - Of or pertaining to the skin.

Dermal Sensitization - An exposure of an agent to skin which results in an immune response. Subsequent exposure will often induce a much stronger (secondary) immune response.

Dermal Toxicity - Adverse toxic effects resulting from skin exposure to a substance.

Dermatitis - Inflammation, irritation, or reddening of the skin.

DOL - U.S. Department of Labor: it includes the Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA), and other agencies.

DOT - U.S. Department of Transportation: it regulates transportation of chemicals and other hazardous and nonhazardous substances.

DOT Hazard Class - Classification by the U.S. Department of Transportation which describes the type of hazard that may be encountered in an emergency during transport. For example, flammable, combustible, poison.

Dry Chemical - A powdered fire-extinguishing agent specially treated so that it will flow properly. It may be used on fires involving flammable and combustible materials (class B and C fires). It extinguishes fires by stopping the progressive chemical reaction that take place during a fire.

Dusts - Solid particles generated by some mechanical process, such as crushing, grinding, abrasion, or blasting.

E

Effects of Overexposure - Clinical signs and symptoms that may occur or be experienced when one has been overexposed to concentrations of a particular substance above established exposure limits.

Emergency and First-Aid Procedures - This refers to the recommended first-aid procedures, based on the inherent toxicity of the product and the route of exposure to the product.

Erythema - A name applied to redness of the skin that may result from exposure to a substance or product.

Excepted from DOT Regulations - Hazard classification applied to substances that are not included in any of the other Department of Transportation hazard classes.

Explosion Hazard - A hazard that may result from exposure of a substance to heat or flame.

Explosive - Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, that is, with instantaneous release of gas and heat (energy). Also, any material having the properties of an explosive.

Explosive (Class A) - Department of Transportation hazard classification for those substances that pose a detonating or otherwise maximum explosion hazard.

Explosive (Class B) - Department of Transportation hazard classification for those substances that function by rapid combustion rather than by detonation. Includes some explosive devices such as special fireworks, flash powders.

Explosive (Class C) - Department of Transportation hazard classification for those types of manufactured articles containing Class A or Class B explosives, or both, as components but in restricted quantities. Minimum hazard.

Explosive Limits - The range of concentration of a flammable gas or vapor (percent by volume in air) in which explosion can occur if an ignition source is present. Also see "flammable limits," "LEL," and "UEL."

Exposure Limit - Limit set to minimize occupational exposure to a hazardous substance. Recommended occupational exposure limits used are American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Mandatory limits are the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).

Extinguishing Agents (Methods) - Agent(s) suitable for controlling or putting out a fire, when properly applied.

Eye Protection - Recommended safety glasses, shields, goggles, and other headgear to be used when handling the material - to protect against accidental eye contact.

F

Fahrenheit - (F) The thermometric scale in which, under standard atmospheric pressure, the boiling point of water is 212 degrees above the zero of the scale; the freezing point of water is at 32 degrees above zero of the scale.

Fetal - Of or pertaining to a fetus, the unborn young of a person or animal while still in the uterus.

Fibrosis - A condition marked by the abnormal increase in the amount of fibrous connective tissue in an organ or tissue.

Fire Hazard - A hazard that may result from exposure of the product to heat or flame.

Fire Point - The lowest temperature at which a material can evolve vapors fast enough to support continuous combustion.

First-Degree Burn - A mild burn characterized by pain and reddening of the skin.

Flammable - A material that is easily ignited and burns with extreme rapidity.

Flammable Aerosol – An aerosol that yields a flame projection for more than 18” at full valve opening, or a flash back (a flame extending back to the valve) at any degree of valve opening.

Flammable Gas - A DOT hazard classification applied to a compressed gas meeting the requirements of the lower flammability limit, flammability range limit, flame projection, or flame propagation criteria.

Flammable Limits - The range of a vapor or gas concentration in air that will burn or explode if an ignition source is present. See also “explosive limits.”

Flammable Liquid - As defined by the Department of Transportation, it is any liquid with a flash point, as determined by a closed cup method, below 100 degrees F (38 degrees C) and a vapor pressure not exceeding 40 psi absolute at 100 degrees F (3kg/sq cm absolute at 38 degrees C).

Flammable Solid - DOT hazard classification applied to any solid material, other than an explosive, that is liable to cause fire through friction, or retained heat from manufacturing or processing. Any solid that can readily be ignited and, when ignited, can burn so vigorously and persistently as to create a serious transportation hazard.

Flash Point - The minimum temperature at which a liquid gives off sufficient vapor to form, with air, an ignitable mixture.

Fumes - Fumes are formed by processing, such as combustion, sublimation, or condensation. The term is generally applied to the metal oxides of such metals as zinc, magnesium, or lead.

G

Gas - Normally formless fluids that occupy the space of their enclosure and that can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature.

General Exhaust - Removal of contaminated air from a large area by use of an air-circulation or exchange system. See also “local exhaust.”

H

Hazardous Material - Any substance or mixture of substances having properties capable of producing adverse effects on the health or safety of a human being.

Hazardous Reaction/Decomposition - An indication of the relative hazards of the by-products, including the generation of heat or explosion, that may result from a chemical change of the product.

Highly Toxic - A chemical that:

- has a median lethal dose (LD₅₀) of 50 milligrams or less per kilogram of body weight.
- has an LD₅₀ of 200 milligrams per kilogram of body weight when administered by continuous contact for 24 hours.
- has a median lethal concentration (LC₅₀) in air of 200 ppm by volume of gas or vapor, or 2 milligrams per liter or less of mists, fumes or dust, administered by continuous inhalation for one hour.

I

Ignitable - A solid, liquid, or compressed gas that exhibits a “characteristic of ignitability,” as defined by the Resource Conservation and Recovery Act (RCRA), and may be regulated (by the Environmental Protection Agency) as a hazardous waste.

Ignition Source - Anything that provides heat, spark, or flame sufficient to cause combustion or explosion.

Incendiary Spark - A small, hot glowing particle of a substance thrown out by a body in combustion, or remaining when combustion is nearly complete. This particle is capable of igniting other combustible or flammable materials, gases, vapors, or dusts.

Incompatible - Materials that could cause dangerous reactions from direct contact with one another are described as incompatible.

Ingestion - Taking a substance into the body (stomach) through the mouth; swallowing.

Inhalation - Drawing a substance into the body (lungs) through the nose, mouth, and breathing passages, in the form of a gas, vapor, fume, mist, or dust.

Irritant - A substance that will cause an inflammatory response or reaction of the eye, skin, or respiratory system, following single or multiple exposures.

Irritating Material - As defined by the Department of Transportation, is a liquid or solid substance which upon contact with fire or when exposed to air, gives off dangerous or intensely irritating fumes (not including poisonous material). (See Poison, Class A and Poison, Class B.)

L

LC₅₀ - Lethal Concentration 50; the concentration of a material in air, which, on the basis of laboratory tests, is expected to kill 50% of a group of test animals when administered as a single exposure (usually of 1 or 4 hours' duration).

LD₅₀ - Lethal Dose 50; a single dose of material which, on the basis of laboratory tests, is expected to kill 50% of a group of test animals. The material may be administered by mouth (oral) or applied to the skin (dermal or cutaneous).

LEL or **LFL** - Lower Explosive Limit or Lower Flammable Limit of a flammable vapor or gas in air (usually expressed in percent by volume) below which propagation of a flame will not occur in the presence of an ignition source. Also see "UEL."

Local Exhaust - A system for capturing and removing airborne contaminants (gases, particulates) at the point at which they are released. Not to be confused with general exhaust.

M

mg/kg - Milligrams per kilogram. An expression of toxicological dose. See "g/kg."

mg/m³ - Milligrams per cubic meter of air; a unit for measuring concentrations of particulates in the air (a weight per unit volume).

Mist - Suspended liquid droplets in the air generated by condensation from the gaseous to the liquid state, or by breaking up a liquid into a dispersed state by splashing, foaming, or atomizing.

Mixture - A combination of two or more substances that may be separated by mechanical means. The components may not be uniformly dispersed. Also see "solution."

Mucous Membrane - Mucous-secreting membrane lining the hollow organs of the body, for example, the nose, mouth, stomach, intestines, bronchial tubes, and urinary tract.

Mutagen - A substance or agent capable of altering the genetic material of a living cell.

N

Nasal Cavity - Either of the pair of cavities in the nose separated by a septum, the thin wall between the two halves of the nose.

Neutralize - To render chemically neutral or harmless; neither acid nor base; to counteract the activity or effect of. The addition of a base (sodium hydroxide) to an acid

hydrochloric acid) results in water and a salt (sodium chloride); thus the acid has been “neutralized” or rendered harmless.

NFPA - National Fire Protection Association. Founded in 1896, it is an independent, voluntary membership, nonprofit organization dedicated to the safeguarding of people and their environment from destructive fire using scientific and engineering techniques and education.

NIOSH - National Institute for Occupational Safety and Health. Part of the Centers for Disease Control and Prevention in the U.S. Department of Health and Human Services (DHHS); a Federal agency which, in addition to other activities, tests and certifies respiratory protective devices and air sampling detector tubes, recommends occupational exposure limits for various substances, and assists OSHA in occupational safety and health investigations and research.

Noncombustible - A material that will not ignite, burn, support combustion, or release flammable vapors when subjected to heat or fire.

Non-Flammable Gas - DOT hazard classification applied to any compressed gas other than a flammable compressed gas.

O

Odor - Odor is described in comparison to common, familiar “smells.” Odor threshold refers to the concentration required in the air before vapors are detected or recognized.

Oil-Impervious Garments - Clothing that does not allow the entrance or passage of oil to the skin, as with oil-impervious (protective) gloves.

Oil Mist - Oil, in the form of fine particles, formed by atomization floating or falling in the atmosphere; a fine spray of oil particles suspended in the air.

Olfactory - Relating to the sense of smell. The olfactory region of the nasal mucosa is the area that detects odors and transmits information to the brain via the olfactory nerves.

Oral LD 50 - Oral Lethal Dose 50; the concentration of a substance administered by mouth that will produce death in 50 percent of the animals tested.

Oral Toxicity - Adverse effects that result from taking a substance into the body via the mouth.

Organic Peroxide - A Department of Transportation hazard classification applied to an organic compound containing the bivalent -OO- structure and that may be considered a derivative of H₂O₂ in which one or more of the hydrogen atoms have been replaced by organic radicals.

ORM-A - A Department of Transportation hazard classification applied to a material which has an anesthetic, irritating, noxious, toxic, or other similar property and which can cause extreme annoyance or discomfort to passengers and crew in the event of leakage during transportation.

ORM-B - A Department of Transportation hazard classification applied to a material (including a solid when wet with water) capable of causing significant damage to a transport vehicle or vessel by leaking during transportation.

ORM-C - A Department of Transportation hazard classification applied to a material that has other inherent characteristics not described as an ORM-A or ORM-B, but that make it unsuitable for shipment unless properly identified and prepared for transportation.

ORM-D - A Department of Transportation hazard classification applied to a material such as a consumer commodity which, though otherwise subject to the regulations of the DOT hazard classification system, presents a limited hazard during transportation due to its form, quantity, and packaging.

ORM-E - DOT hazard classification applied to a material which is not included in any other hazard class but which is subject to the requirements of the DOT regulations. Materials in this class include "Hazardous Waste" and other hazardous materials.

OSHA - Occupational Safety and Health Administration of the U.S. Department of Labor; a Federal agency with safety and health regulatory and enforcement authority for most U.S. industries and businesses.

Oxidizer - Department of Transportation defines an oxidizer or oxidizing materials as a substance that yields oxygen readily to stimulate the combustion (oxidation) of organic matter. Chlorate (ClO_3) permanganate (MnO_4), and nitrate (NO_3) compounds are examples of oxidizers.

OXY - NFPA special hazard rating for oxidizer.

P

Particulate - Airborne solids or liquids. Dusts, fumes, smokes, mists, and fogs are all examples of particulates.

PEL - Permissible Exposure Limit: an exposure limit established by OSHA's regulatory authority. May be a time weighted average (TWA) limit or a ceiling concentration exposure limit.

Photosensitization (contact) - After exposure to some chemical substance(s), the skin, upon exposure to light, may swell or exhibit dermatitis.

PMCC - Pensky Martens Closed Cup; a flash-point test method.

Pneumonitis - Inflammation of the lungs, which may be caused by inhalation of chemical irritants.

Poison, Class A - A Department of Transportation term for extremely dangerous poisons; that is, poisonous gases or liquids of such nature that a very small amount of the gas, or vapor of the liquid, mixed with air, is dangerous to life. Some examples: phosgene, cyanogen, hydrocyanic acid, nitrogen peroxide.

Poison, Class B - A Department of Transportation term for liquid, solid, paste, or semisolid substances—other than Class A poisons or irritating materials—that are known (or presumed, on the basis of animal tests) to be so toxic to man as to afford a hazard to health during transportation.

ppb - Parts per billion: a unit for measuring the concentration of a gas or vapor in air; parts (by volume) of the gas or vapor in a billion parts of air. Usually used to express measurements of extremely low concentrations of unusually toxic gases or vapors. Also used to indicate the concentration of a particular substance or solution.

ppm - Parts per million: a unit for measuring the concentration of a gas or vapor in contaminated air. Also used to indicate the concentration of a particular substance in a liquid or solid.

Precautionary Statements - Statements warning product users of potentially harmful hazards that may be attributed to the product, even though a complete toxicological evaluation of the product has not been performed.

Product/Material - Name of the product or material; usually found at the beginning of the MSDS.

Protective Cream - A protective skin cream provides an invisible flexible protection for the hands from soils, solvents, dusts, powders, oils, greases, paints, epoxies, resins, inks, and irritants. It can be easily removed by washing with any cleansing product.

Protective Garment - Specially manufactured clothing designed to provide protection to the wearer against contamination from chemical, biological, radiation, or physical hazards.

Pulmonary Edema - The abnormal accumulation of fluid in the tissues and air spaces of the lungs.

R

RAD - NFPA special hazard rating for radiation.

Radioactive - The property of an isotope of an element that is characterized by giving off radiant energy in particles or rays by the disintegration of atomic nuclei.

Radioactive Material - DOT hazard classification applied to any material or combination of materials that spontaneously emit ionizing radiation having a specific activity greater than 0.002 microcuries/g.

Radioactivity - Emission of energy in the form of alpha, beta, or gamma radiation from the nucleus of an atom. Always involves change of one atom into a different kind. A few elements, such as radium, are naturally radioactive. Other radioactive forms are artificially induced.

Reaction - A chemical transformation or change; the interaction of two or more substances to form new substances.

Reactivity - The tendency of a substance to undergo a chemical change with the release of energy. Reactive chemicals are liable to cause fire or promote an explosion. Undesirable effects (pressure buildup, temperature increase, formation of noxious, toxic, or corrosive by-products) may occur because of a reaction to heating, burning, direct contact with other materials, or other conditions when in use or in storage.

Reducing Agent - In an oxidation-reduction reaction, the reducing agent is the material that is oxidized or is responsible for the reduction. Reduction occurs when an atom undergoes a decrease in oxidation number.

Reproductive Toxicity Data - Information obtained through reproduction tests, which may be carried through several generations of test animals. This testing attempts to assess the changes in reproductive functions of parental animals including the fertility, the incidence of birth defects, and changes in the reproductive system as a result of parental exposure to a substance.

Respiratory Protection - Devices for use in conditions exceeding the permissible exposure limits, which, when properly selected, maintained, operated, and worn by the user, will protect the user's respiratory system from exposure to airborne contaminants by inhalation.

Respiratory System - The breathing system; includes the lungs and the air passages (trachea or windpipe, larynx, mouth, and nose) to the air supply outside the body, plus the associated nervous and circulatory systems.

RTECS - Registry of Toxic Effects of Chemical Substances; a compendium of toxicity data extracted from scientific literature. Inclusion of data in the registry does not mean endorsement of the reference. Evaluation of cited references is the responsibility of the reader.

S

SCBA - Self Contained Breathing Apparatus provides a substitute source of clean breathing air from a separate tank carried on the person.

Second-Degree Burn - A burn that is more severe than a first-degree burn and is often characterized by blistering, reddening of the skin, edema (swelling), and destruction of the superficial tissue.

Sensitizer - A substance which, on first exposure, causes little or no reaction in man or test animals but which, on subsequent exposure(s), may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form of the problem in the industrial setting, although respiratory sensitization to a few chemicals has been known to occur. Poison ivy is a common sensitizer outside the work setting.

Simple Asphyxiant - A substance that causes a deficiency in the supply of oxygen to the tissue by excluding oxygen from the inhaled atmosphere. Nitrogen, propane, and acetylene are examples.

Skin Lesion - An abnormal change in the structure of the skin due to injury or disease.

Skin Protection - Refers to the recommended type of gloves, protective creams, and outerwear to be worn when handling the product.

SO_x - Oxides of sulfur; undesirable air pollutants. SO_x emissions are regulated by EPA under the Clean Air Act.

Specific Gravity - The ratio of the weight of a volume of material to the weight of an equal volume of water, usually at 60 degrees F, unless otherwise specified

Spill and Leak Procedure - Procedures, precautions, and methods used in the cleanup of a substance.

Stability - An expression of the ability of a material to remain unchanged. A material is stable if it remains in the same form under expected and reasonable conditions of storage and use. Conditions that may cause instability are stated on the MSDS.

Static Electricity - If two objects are in close physical contact and then separated, the objects sometimes collect an electrical charge through friction or induction. Similar electrical charges can be generated by rapid flow of gases or liquids. If the objects are

not bonded or grounded, they may accumulate sufficient electrical charges so that an electrostatic discharge (spark) between them may occur.

STEL - Short Term Exposure Limit; American Conference of Governmental Industrial Hygienists' terminology. See "TLV-STEL."

Subchronic Toxicity Data - Data resulting from "subchronic toxicological tests," in which the substance being tested is administered to animals on a daily basis, for test periods generally ranging from 2 to 13 weeks.

Systemic Toxicity - The adverse effects caused by a substance that affects the body in a general rather than a local manner.

T

Target Organ Effect - Damage caused in a specific organ following exposure to certain chemicals. For example, a "neurotoxin" is a chemical, such as mercury, that produces its primary toxic effect on the nervous system.

TCC - Tag (Tagliabue) Closed Cup - a flash-point test method.

Teratogen - A substance which, upon exposure of the parent, causes "teratogenic changes," that is, malformations or alterations in the appearance or function of the fetus.

Third-Degree Burn - The most serious type of burn, characterized by charring (blackening) of the skin and by skin necrosis (tissue death).

TLV - Threshold Limit Value: a term used by the American Conference of Governmental Industrial Hygienists (ACGIH) to express the airborne concentration of a material to which nearly all persons can be exposed day after day, for a normal 8-hour workday or 40-hour work-week, without adverse effects.

TLV-C - Threshold Limit Value - Ceiling Exposure Limit: the concentration that should not be exceeded, even momentarily.

TLV-STEL - Threshold Limit Value - Short-Term Exposure Limit; maximum concentration for a continuous 15-minute period (maximum of four such periods per day, with at least 60 minutes between exposure periods), provided that the daily TLV (time weighted average) is not exceeded.

TOC - Tag (Tagliabue) Open Cup; a flash-point test method.

Toxic - Describes a substance that:

- has an LD₅₀ of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats.
- has an LD₅₀ of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours with the bare skin of albino rabbits.
- has an LC₅₀ in air of more than 200 ppm but not more than 2,000 ppm by volume of gas or vapor when administered by continuous inhalation for one hour to albino rats.

Toxicity - Basic biological property of a material reflecting its inherent capacity to produce injury; adverse effects resulting from overexposure to a material, generally via the mouth, skin, eyes, or respiratory tract.

Toxicology - The study of the harmful effects of chemicals on biological systems.

Toxicology Data - This section of the MSDS contains toxicological data such as oral, dermal, inhalation toxicity; eye, skin irritation; dermal sensitization; and environmental, reproductive, genetic, chronic, subchronic, and other toxicity data.

TWA - Time Weighted Average exposure; the airborne concentration of a material to which a person is exposed, averaged over the total exposure time, generally the total workday (8 to 12 hours). It is calculated by multiplying measured concentration levels times the duration of exposure (in hours), adding these values together, then dividing by the total sampled time (in hours). Also see "TLV" and "PEL."

U

UN/NA Number - Numerical designation for transportation hazards:

UN = United Nations; NA = North America.

Unstable - Tending toward decomposition or other unwanted chemical change during normal handling or storage.

UEL or **UFL** - Upper Explosive Limit or Upper Flammable Limit - The highest concentration of a flammable vapor or gas in air (usually expressed in percent by volume) above which propagation of a flame will not occur in the presence of an ignition source. Also see "LEL."

V

Vapor Density - Relative density or weight of a vapor or gas compared to weight of an equal volume of air. Materials lighter than air, such as acetylene, have vapor densities

less than 1.0. Materials heavier than air, such as propane, will have densities greater than 1.0.

Vapor Pressure - The pressure exerted by a saturated vapor above its own liquid in a closed container.

Ventilation - See “general exhaust,” “local exhaust,” and “mechanical exhaust.” As used in the context of the MSDS, this refers to recommended air flow schemes to control airborne concentrations of hazardous substances in the atmosphere.

Volatility - The tendency or ability of a liquid to vaporize. Liquids such as alcohol and gasoline, because of their tendency to evaporate rapidly, are called volatile liquids.

W

Waste Disposal Methods - Methods to be used in disposal of this product and/or materials used in the cleanup of this product as recommended by local, state, and Federal authorities.

Waterless Skin Cleanser - A commercially available paste or liquid used for the removal of hydrocarbon-based substances, dirt, and contamination from the skin without the use of solvents. It is generally recommended that, after using a waterless skin cleanser, the worker wash the contaminated skin area a second time using ordinary bath soap.

APPENDIX B

Sources of Help and References

Article I. OSHA Hazard Communication Standard (29 CFR 1910.1200)

1. *Hazard Communication Compliance Manual: A User's Guide to OSHA's Hazard Communication Standard*, Silk, J.C. and Kent, M.B., eds. For the Society of Chemical Hazard Communication, Bureau of National Affairs, Washington, D.C., 1995.
2. Silk, J.C., "Hazard Communication," *The Occupational Environment – Its Evaluation and Control*, DiNardi, S. R. ed. American Industrial Hygiene Association, 1997.
3. U.S. Department of Labor, Occupational Safety and Health Administration website www.osha.gov. Go to H in the alphabetical index for Hazard Communication. See Appendix E (Guidelines for Employer Compliance-Advisory) for additional guidance.

Section 1.01 Training Guidance- Additional Sources of Help

1. American Society for Training and Development (ASTD): *Basic Training for Trainers*, Vol. 1-3, ASTD Publishing Services, Baltimore, MD, 1996. See also www.astd.org
2. American Society for Training and Development (ASTD): *Toolkit Series: Lesson Plans*, ASTD Publishing Services, Baltimore, MD, 1995.
3. American Society for Training and Development (ASTD): *Training and Development Handbook*, 4th ed. R.L. Craig ed. ASTD Publishing Services, Baltimore, MD and McGraw-Hill, New York, 1996.
4. American Distance Education Consortium: On-Line Resources, www.adec.edu/online-resources.html
5. American National Standards Institute (ANSI), *ANSI Z-490, Criteria for Accepted Practices in Safety, Health and Environmental Training*, American National Standards Institute, New York, 2000.
6. Cohen, A., and Colligan, M.J., *Assessing Occupational Safety and Health Training – A Literature Review*, National Institute for Occupational Safety and Health (NIOSH), Cincinnati, 1998.
7. Head, G.E., *Training Cost Analysis: A How-To Guide for Trainers and Managers*. ASTD Publishing Services, Baltimore, MD, 1993.
8. Lucent Technologies, Center for Excellence in Distance Learning (CEDL), www.lucent.com/cedl
9. National Audiovisual Center, 1994 Reference List of Audiovisual Materials, National Audiovisual Center, Washington, DC, 1994.
10. National Clearinghouse for Worker Safety and Health Training, *Computer and Internet-Based Learning Methods for Safety and Health Training: Summary of Background Research*, National Clearinghouse for Worker Safety and Health, Washington, DC, 1999.
11. National Institute of Occupational Safety and Health (NIOSH), Web Site Training Resources, www.cdc.gov/niosh

12. Samways, M.C., "Training," in *Hazard Communication Compliance Manual*, Silk, J., and Kent, M.B. eds. For the Society of Chemical Hazard Communication, Bureau of National Affairs, Washington, D.C., 1995.
13. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) OSHA publications and audiovisual programs. OSHA 2019. OSHA Publications and Distribution Office, U.S. Department of Labor, Room N-3101, Washington, DC.
14. U.S. Department of Labor, Occupational Safety and Health Administration, *Voluntary Training Guidelines – OSHA Publication No. 2254*, available from the OSHA Publications Distribution Office or from any Government Printing Office.
15. U.S. Distance Learning Association, www.usdla.org
16. Web Based Training Association, www.wbta.org

APPENDIX C. LESSON PLANS

Lesson A: Understanding the Hazard Communication Standard

Lesson Plan Worksheet

Lesson Title:	Understanding the Hazard Communication Standard (HCS)		
Intended Audience:	All employees who fall under the HCS		
Prerequisite:	None		
Time Required:	35 to 60 minutes (depending if a video is shown)		
<i>Materials and Equipment Needed</i>	<i>Learning Objectives</i>		
<ul style="list-style-type: none"> ◆ Lesson plan ◆ Copy of your hazard communication written program to show ◆ Copy of an example of a chemical inventory or part of an inventory, if available ◆ Lap top computer/computer projector OR ◆ Overhead projector/overhead transparencies made from slides ◆ Marker, for writing on overhead transparencies Some blank overhead transparencies, for use as necessary ◆ Handouts made from paper copies of slides ◆ 35mm slide projector, if needed ◆ Screen ◆ Video and video playback equipment, if needed ◆ Copies of quiz 	<ul style="list-style-type: none"> ◆ Employees will be able to identify the purpose of the HCS ◆ Employees will recognize the 5 major sections of the HCS ◆ Employees will indicate, in a quiz or orally, how and where hazard communication information is available at their site ◆ Employees will recognize, in a quiz or orally, who has responsibility for hazard communication functions at their site 		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
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Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<p><u>Introduce</u> yourself</p> <p><u>Circulate</u> attendance sheet</p> <p><u>Introduce</u> topic: Understanding the Hazard Communication Standard (HCS)</p>	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Overview of lesson	<p>Overview of lesson</p> <p><u>Ask</u> if anyone present has heard of or is familiar with the HCS</p> <p>If parts of HCS have already been implemented at your site, <u>remind</u> participants</p> <p><u>State</u> the purpose of the standard: ...to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazard is transmitted to employers and employees.</p> <p><u>Explain</u> that hazards are communicated through container labeling and other forms of warning, material safety data sheets, and employee training</p>	Slide No. 2: Purpose of HCS

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Time unknown		NOTE: If you have obtained a video outlining the HCS, show it now	Video (optional)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Learning objectives	<p><u>State</u> the following course objectives:</p> <ul style="list-style-type: none"> ◆ Employees will be able to identify the purpose of the HCS ◆ Employees will recognize the 5 main sections of the HCS ◆ Employees will indicate (in a quiz/orally) how and where hazard communication information is available at their site ◆ Employees will recognize (in a quiz/orally) who is responsible for this function at their site 	Slide No. 3: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Identification of responsible staff	<p><u>Describe</u> who is responsible in your workplace for:</p> <ul style="list-style-type: none"> ◆ Identifying hazardous chemicals ◆ Preparing and implementing the written program ◆ Making sure that in-plant containers are labeled, tagged or marked with the identity of the material and appropriate hazard warning ◆ Ensuring adequate labeling of shipped containers if you are a manufacturer, importer or distributor ◆ Obtaining/maintaining MSDS information and training programs 	<p>Slide No. 4: Who Is Responsible</p> <p>On Slide No. 4, fill in the names of responsible staff, either on the computer or, if using overheads, with a marker</p>

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	Identification of hazardous chemicals in the workplace [see paragraph (b) in the HCS for exemptions]	<p><u>Explain</u> that the HCS covers all chemicals that manufacturers/importers have evaluated and classified as hazardous. This evaluation is described on the material safety data sheet issued by the manufacturer. They can include:</p> <ul style="list-style-type: none"> ◆ Liquids in containers ◆ Substances in pipes ◆ Chemicals generated in work operations such as welding fumes and exhaust fumes ◆ Solids, gases and vapors <p><u>Explain</u> that if there is no hazard, the rule does not cover the chemical</p> <p><u>Show</u> an example of the chemical inventory from one of your work sites, if available</p> <p><u>Ask</u> the class if they can think of examples of hazardous chemicals from their various work sites</p>	Slide No. 5: Identification of Hazardous Materials

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Written Program [see paragraph (e) of the HCS]	<p><u>Explain</u> that the written program includes everything that has been done in your site to comply with the HCS – it is a “blueprint” for compliance.</p> <p><u>Outline</u> the elements of the written program, providing details specific to your site:</p> <ul style="list-style-type: none"> ◆ List of hazardous chemicals ◆ Labels and other forms of warning <ul style="list-style-type: none"> • Designation of responsibility for in-plant container • Designation of responsibility for shipped containers • Description of labeling system used • Description of alternatives to the labeling of in-plant containers • Procedures to transfer and update labeling information ◆ Material Safety Data Sheets <ul style="list-style-type: none"> • Designation of responsibility • Maintenance and access • Procedures for obtaining missing MSDSs • For producers, procedures to update MSDSs • Description of alternatives to hardcopies of MSDSs, if used ◆ Employee information and training <ul style="list-style-type: none"> • Designation of training responsibility • Description of program • Elements of program • Procedures to train employees at time of initial assignment, and to train employees when a new hazard is introduced • Hazards of non-routine tasks • Informing other employers at multi-employer work sites <p><u>Note</u> that contract employees, such as outside maintenance workers, also need to receive the information</p> ◆ Availability/accessibility of written program 	Slide No.6: Elements of the Written Program

Time (minutes)	Subject Outline	What to Do	Aids/Cue
		<u>Show</u> your written program and describe where it is kept	

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Labels and other forms of warning [paragraph (f) in the HCS]	<p><u>Describe</u> that labels must have 3 pieces of information from manufacturers:</p> <ul style="list-style-type: none"> ◆ Identity of chemical ◆ Appropriate hazard warning ◆ Name and address of manufacturer <p>Workplace containers must show identity and appropriate hazard warning</p> <p><u>Describe</u> how the identity on the label can be any name that links the label, the MSDS, and the inventory list of chemicals</p> <p><u>Describe</u> briefly what has been done at your site to label, tag, or mark the identity of hazardous chemicals</p> <p><u>Describe</u> how you handle the labeling of containers to which materials are transferred</p> <p><u>Explain</u> that there is a separate more detailed lesson plan on “Understanding Labels”</p>	Slide No. 7: Labels and Other Forms of Warning

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Material Safety Data Sheets [paragraph (g) in the HCS]	<p><u>Describe</u> the MSDS as a detailed document that communicates hazard information to employers, employees, physicians, other health professionals, and emergency personnel</p> <p><u>Describe</u> where the MSDSs are located at your site. If helpful, show a plot plan</p> <p><u>Explain</u> that there is not a uniform format. There is a separate lesson plan on “Understanding the MSDS”</p> <p><u>Ask</u> the class if they have used MSDS. What was their experience?</p>	Slide No. 8: MSDSs

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Information and training [paragraph (h) of the HCS]	<p><u>Explain</u> that this course helps to meet the information and training requirements of the HCS</p> <p><u>Describe</u> what employees should be informed of:</p> <ul style="list-style-type: none"> ◆ Requirements of the HCS ◆ Operations in their work area where there are hazardous chemicals ◆ Location and availability of the Written Program <p><u>Describe</u> what training is required:</p> <ul style="list-style-type: none"> ◆ Methods and observations to detect the presence or release of hazardous chemicals ◆ Physical and health hazards of chemicals in the work area ◆ How they can protect themselves ◆ Details of the hazard communication program <p><u>Explain</u> that all information and training specific to individual work areas will be given to each group at the site-specific level</p>	Slides No. 9 & 9A: Information and Training

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary	<p><u>Summarize and review</u></p> <ul style="list-style-type: none"> ◆ Purpose of HCS ◆ 5 major sections: <ul style="list-style-type: none"> • identification of hazardous chemicals • written program • labels and other forms of warning • MSDSs • information and training ◆ How and where hazard communication information is available at your site ◆ Who is responsible for HCS functions <p>If there is time, <u>discuss</u> employees' understanding of the HCS, and <u>repeat</u> main points</p>	Slide No. 10: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show an overhead of quiz items for group response	Handouts of quiz, OR make overhead of quiz for group response

Lesson B: Understanding the Material Safety Data Sheet

Lesson Plan Worksheet

<p>Lesson Title: Understanding the Material Safety Data Sheet Intended Audience: All employees who fall under the HCS Prerequisite: Understanding the Hazard Communication Standard Time Required: 30 to 45 minutes (depending if a video is shown)</p>	
<p><i>Materials and Equipment Needed</i></p> <ul style="list-style-type: none">◆ Lesson plan◆ Samples of some MSDSs from your operation. Slides of MSDSs, if possible◆ Overhead projector◆ Screen◆ Overhead slides/paper copies at end of Lesson Plan◆ Some blank overhead transparencies, for use as necessary◆ Marker, for writing on overhead transparencies◆ Computer projector and laptop computer if available◆ Handouts/paper copies at the end of Lesson Plan◆ Copies of <u>Glossary of Commonly Used Terms</u>◆ Video and video playback equipment, if needed◆ Copies of quiz	<p><i>Learning Objectives</i></p> <ul style="list-style-type: none">◆ Employees will recognize the purpose of the MSDS◆ Employees will identify key requirements of the MSDS◆ Using a glossary, employees will look up common terms used in MSDSs◆ Employees will state where MSDSs are located in their work area

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself <u>Circulate</u> attendance sheet <u>Introduce</u> topic: Understanding the Material Safety Data Sheet (MSDS)	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<u>State</u> the following course objectives: <ul style="list-style-type: none"> ◆ Employees will recognize the purpose of the MSDS ◆ Employees will identify key requirements of the MSDS ◆ Using a glossary, employees will look up common terms used in MSDSs ◆ Employees will state where MSDSs are located in their work area 	Slide No. 2: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Overview of lesson	<p><u>Ask</u> if anyone is familiar with MSDSs</p> <p><u>Hold up</u> or <u>pass around</u> some samples from your site OR copy an MSDS on acetate to show as an overhead</p> <p><u>Remind</u> participants that the MSDS is a key component of the hazard communication program. It is accessible to them at all times</p> <p><u>Pass out</u> copies of the Glossary</p> <p><u>Explain</u> that this will help employees to understand technical terms</p>	<p>Slide No. 3:</p> <p>An MSDS (make an overhead of or reproduce electronically one of the MSDSs at your site)</p>

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Purpose of the MSDS	<p><u>Describe</u> its purpose - It provides detailed information about chemical hazards to employers, employees, health professionals and emergency personnel. It is developed by the chemical manufacturer. Employers must have an MSDS for each hazardous chemical they use.</p>	<p>Slide No. 4:</p> <p>Purpose of the MSDS</p>

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Time unknown	NOTE: If you have a video about MSDSs, show it now		Video (optional)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Contents of the MSDS	<u>Explain</u> that the MSDS contains many sections. Although all are available to the employee, some are designed to help health professionals, fire fighters and others to do their job in an emergency or when protective measures are planned. MSDSs vary in format.	Slide No. 5: An MSDS (a slide showing another MSDS from your site)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Requirements: Identity used on the label	<u>Go through</u> the sections of a sample MSDS (if possible, <u>pass out</u> as a handout or <u>show</u> as a slide) and <u>explain</u> the meaning of each section. <u>Explain</u> that the sections are not always in this order. The MSDS must contain the identity used on the label. This can be the material/trade name, product number and/or common synonyms. <u>Show</u> or <u>point</u> to the chemical or common name on a paper MSDS or on a slide of one of your MSDSs. If your MSDS represents a mixture, <u>show</u> how the percentages of components are listed.	Slide No. 6: Requirements: Identity Used on the Label: Chemical or Common Name (write on the slide the chemical and/or common name of a chemical used at your site)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Physical and chemical characteristics	<p><u>Describe</u> that this means characteristics such as vapor pressure, boiling point and flash point. If employees are not familiar with these terms, <u>refer</u> to the glossary for descriptions.</p> <p><u>Show</u> or <u>point to</u> descriptions of physical characteristics on a paper MSDS or slide.</p>	Slide No. 7: Requirements: Physical and Chemical Characteristics

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Requirements: Physical hazards	<p><u>Describe</u> these as the potential for fire, explosion or reactivity. <u>Refer</u> to Glossary for descriptions of “flash point,” “autoignition temperature” and “flammable limits.”</p> <p><u>Explain</u> that reactivity involves a chemical’s stability, incompatibility and conditions contributing to reactivity. It tells you the conditions and chemicals with which this chemical should <u>not</u> come into contact. It also explains hazardous decomposition products, such as carbon monoxide created by burning urethane foam.</p> <p><u>Give an example</u>, using an MSDS from your work site.</p> <p><u>Point out</u> any unusual fire, explosion or reactivity hazards.</p>	Slide No. 8: Requirements: Physical Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Requirements: Health hazards	<p><u>Explain</u> that this includes signs and symptoms of overexposure and any medical conditions which may be aggravated by exposure to the chemical. Examples of acute signs/symptoms are eye irritation or loss of consciousness. Examples of signs/symptoms from chronic exposure are allergies, organ damage or cancer. <u>Give an example</u>, using an MSDS from your work site. <u>Explain</u> the link to first aid procedures.</p>	Slide No. 9: Requirements: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Requirements: Routes of entry	<p><u>Describe</u> the main routes of entry as:</p> <ul style="list-style-type: none"> ◆ breathing in through the lungs ◆ contact with the skin ◆ swallowing <p><u>Give an example</u>, using an MSDS from your work site. <u>Explain</u> that this is a very important section -- it explains why certain types of PPE are required to prevent inhalation (breathing in) or contact. <u>Discuss</u> the importance of wearing the correct PPE, and also avoiding contact through the mouth by contaminated fingers. <u>Explain</u> that routes of entry will be discussed again in the Lesson on "Understanding Health Information."</p>	Slide No. 10: Requirements: Routes of Entry

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Exposure limits	<p><u>Explain</u> that OSHA has established legally enforceable “permissible exposure limits” (PELs). Another organization, ACGIH, has established recommended “threshold limit values” (TLVs). These exposure limits indicate maximum acceptable levels of exposure to particular chemicals. The employer is responsible for developing controls that ensure that PELs are not exceeded. The employer may also limit exposures to the TLVs as a matter of good practice. Employees are responsible for using protective measures provided by the employer and being alert to the potential for possible overexposures.</p> <p><u>Give an example</u> of an exposure limit from one of your MSDSs.</p> <p><u>Mention</u> that exposure limits are often listed with the chemical names of hazardous chemicals, early in the MSDS.</p> <p><u>Explain</u> that these words are in the glossary.</p> <p><u>Explain</u> also that exposure limits are discussed again in the lesson on “Understanding Health Information.”</p>	Slide No. 11: Exposure Limits

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Carcinogens/potential carcinogens	<p><u>Explain</u> that a “carcinogen” is any substance that has been shown to cause cancer in animals or humans. <u>Ask</u> the group if they know of any common cancer-causing substances.</p> <p><u>Describe</u> the sources that list carcinogens:</p> <ul style="list-style-type: none"> ◆ National Toxicology Program (NTP) Annual Report ◆ International Agency for Research on Cancer (IARC) ◆ OSHA 	Slide No. 12 and 12a: Requirements: Carcinogens/Potential Carcinogens

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Safe handling procedures	<p><u>Explain</u> that safe handling procedures include all measures that prevent exposure while handling the hazardous chemical, such as:</p> <ul style="list-style-type: none"> ◆ hygienic practices, such as washing hands before eating ◆ protective procedures/equipment for handling and storage, and during repair/maintenance of contaminated equipment ◆ procedures for clean up of spills and leaks ◆ how to dispose of waste materials containing this chemical <p><u>Give an example</u> from your work site.</p>	Slide No. 13: Requirements: Safe Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Control measures	<p><u>Explain</u> that protective measures include:</p> <ul style="list-style-type: none"> ◆ engineering controls, such as ventilation ◆ work practices, such as designing the job so that employees do not become exposed to the chemical ◆ using personal protective equipment, such as gloves to protect the skin or eyewear for the eyes <p><u>Describe</u> some protective measures used at your work site.</p>	Slide No. 14: Requirements: Controls

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Emergency and first aid procedures	<p><u>Explain</u> that different procedures are needed for different chemicals. For example, eyes should be flushed with water following contact with chemicals that irritate the eye.</p> <p><u>Give an example</u> from your work site.</p> <p><u>Be prepared to discuss</u> emergencies that may have occurred at your site.</p> <p><u>You may also want to refer</u> to site emergency plans, such as the Emergency Action Plan and Spill Control Plan.</p>	Slide No. 15: Emergency and First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Requirements: Identity of responsible party and date of preparation	<u>Explain</u> that the chemical manufacturer or other responsible party has to provide additional information, if needed. The name, address and phone number are on each MSDS. There is also a date of preparation. <u>Point</u> to this information on one of your MSDSs.	Slide No. 16: Identity of Responsible Party and Date of Preparation

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Summary	<u>Summarize and review</u> <ul style="list-style-type: none"> ◆ purpose of MSDS ◆ the key requirements ◆ location of MSDSs at your site, or within each employee-group work area. 	Slide No. 17: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show a slide of quiz items for group response	Handouts of quiz OR make slide of quiz for group response

Lesson C: Understanding Labels

Lesson Plan Worksheet

<p>Lesson Title: Understanding Labels Intended Audience: All employees who fall under the HCS Prerequisite: Understanding the Hazard Communication Standard Time Required: 20 to 30 minutes (depending if video is shown and if other labeling/placarding systems discussed)</p>	
<p><i>Materials and Equipment Needed</i></p> <ul style="list-style-type: none"> ◆ Lesson plan ◆ Samples of some labels from your operation ◆ Slides of labels, if possible ◆ Overhead projector ◆ Overhead slides, made from paper copies at end of Lesson Plan ◆ Blank overhead transparencies, for use as necessary ◆ Marker, for writing on overhead transparencies ◆ Computer projector and laptop computer, if available ◆ Handouts made from paper copies at the end of Lesson Plan ◆ Copies of <u>Glossary of Commonly Used Terms</u> ◆ Screen ◆ Video and video playback equipment, if needed ◆ Copies of quiz 	<p><i>Learning Objectives</i></p> <ul style="list-style-type: none"> ◆ Employees will recognize the purpose of labels ◆ Employees will identify 3 key requirements of labels under the HCS ◆ Employees will identify the hazard indicated on a label

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself	Slide No. 1:

Time (minutes)	Subject Outline	What to Do	Aids/Cue
		<p><u>Circulate</u> attendance sheet</p> <p><u>Introduce</u> topic: Understanding labels. “Any written, printed or graphic material displayed on or affixed to container of hazardous chemicals.”</p>	Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<p><u>State</u> the following course objectives:</p> <ul style="list-style-type: none"> ◆ employees will recognize the purpose of labels ◆ employees will identify 3 key requirements of labels under the HCS ◆ employees will identify the hazard(s) indicated on a label 	Slide No. 2: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Overview of lesson	<p><u>Remind</u> participants that “labels and other forms of warning” is one of the 5 major requirements of the HCS. OSHA requires manufacturers, suppliers and importers to label containers of chemicals. Labels were discussed briefly in the lesson on “Understanding the HCS.”</p> <p><u>State</u> the purpose of labels, tags, and other forms of warning. They are “an immediate hazard warning.”</p>	Slide No. 3: Purpose of Labels and Other Forms of Warning

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements -- Three pieces of information	<p><u>Describe</u> the 3 requirements for labels:</p> <ul style="list-style-type: none"> ◆ name of hazardous chemical as it appears on the MSDS and in the inventory list of chemicals ◆ appropriate warning in English ◆ name and address of the manufacturer, importer, or supplier <p><u>Explain</u> that if any of these three is missing, the material should not be accepted into the work site.</p> <p><u>Explain</u> that warnings can be added in other languages, as long as the English warning is present.</p>	Slide No. 4: Key Requirements for Labels

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Sample label	<u>Show</u> a sample from your work site, or <u>copy</u> a label on acetate to show as an overhead, or scan a label to show as a PowerPoint slide.	Slide No. 5: Sample label

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Time Unknown	<u>NOTE:</u> If you have a video outlining HCS label requirements, show it now.		Video (optional)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Labels on incoming containers	<u>Emphasize</u> that labels on incoming containers must not be destroyed, removed or defaced unless immediately replaced with another label containing the required information.	Slide No. 6: Labels on Incoming Containers

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Requirements: Stationary containers	<u>Explain</u> that stationary containers and vessels must be labeled with the name of the substance and an appropriate warning. The warning can be placed directly on the container or be placed on a batch sheet. <u>Discuss</u> an example from your work site.	Slide No. 7: Stationary Containers

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Requirements: Transfer containers	<p><u>Describe</u> the requirement that transfer containers must be labeled if not used immediately. If used within one work shift, a label is not required. It is important that no confusion occur, either because there is more than one unlabeled container being used at the same time, or because personnel other than the one initially transferring the chemical use the chemical.</p> <p><u>Give an example</u> from your work site where an employee transfers a small quantity of a hazardous chemical from a labeled container for immediate use within one work shift.</p>	Slide No. 8: Transfer Containers

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Exceptions	<p><u>Explain</u> that OSHA does not require labels for:</p> <ul style="list-style-type: none"> ◆ pesticides ◆ TSCA-regulated substances ◆ food, food additives and veterinary devices ◆ distilled spirits for non-industrial use ◆ consumer products ◆ agricultural or vegetable seed <p>All of these fall under labeling requirements of other government agencies.</p>	Slide No. 9: Exceptions

NOTE: The next 4 items can be skipped if they do not apply to your work site.

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Labeling and placarding systems: ANSI (omit if ANSI labels are not present in the work area)	<u>Explain</u> that there are several labeling systems. Some of the suppliers of chemicals to your work site use these systems, and employees may be familiar with them. The most common is the American National Standards Institute (ANSI) system. ANSI labels show the chemical name, a signal word (Danger, Warning or Caution), the hazards posed by the substance, a precautionary statement, and first aid procedures. <u>Show</u> or make an overhead or slide of an ANSI label if you have them at your work site.	Slide No. 10: ANSI label

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Labeling and placarding systems: NFPA (omit if not present in the work area)	<u>Explain</u> that National Fire Protection Association (NFPA) labels are designed to protect emergency response personnel from the dangers of hazardous materials stored in stationary containers. They contain sections showing the degree of hazard for: health; fire; reactivity, and specific hazard, such as water-reactive substances. <u>Show</u> or make an overhead or slide of an NFPA label if you have them at your work site.	Slide No. 11: NFPA label

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Labeling and placarding systems: HMIS (omit if not present in the work area)	<u>Describe</u> the Hazardous Materials Identification System (HMIS). This has a similar color coding and numbering system to the NFPA label. <u>Show</u> or make an overhead or slide of an HMIS label if you have them at your work site.	Slide No. 12: HMIS label

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Labeling and placarding systems: DOT labels (omit if not present in the work area)	<u>Explain</u> that all hazardous chemicals transported on the public highway must have a Department of Transportation (DOT) label which must not be removed until containers are emptied and cleaned. <u>Show</u> or make an overhead or slide of a DOT label present on a hazardous substance transported.	Slide No. 13: DOT labels

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Labeling and placarding systems: DOT placards (omit if not present in the work area)	<u>Explain</u> that vehicles carrying hazardous substances into the facility may be placarded. Placards are identical to DOT labels in using graphics (pictograms), words, the United Nations (UN) identification system, and are color coded. Shipping and receiving personnel receive special training in DOT requirements.	Slide No. 14: DOT Placards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary and review	<u>Summarize and review</u> <ul style="list-style-type: none"> ◆ purpose of labels - an immediate hazard warning ◆ key requirements under the HCS ◆ information about labeling and placarding systems at your work site 	Slide No. 15: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show an overhead or slide of quiz items for group response. For Quiz Item No. 3, reproduce or show a label from your site. Ask participants to identify the hazard indicated on the label. They can write, speak or point to the correct answer.	Handouts of quiz OR make overhead or slide of quiz for group response

Lesson D: Understanding Health Information

Lesson Plan Worksheet

<p>Lesson Title: Understanding Health Information Intended Audience: All employees who fall under the HCS Prerequisite: Understanding the HCS; Understanding the MSDS; Understanding Labels Time Required: 40 to 45 minutes (longer if a video is shown)</p>	
<p><i>Materials and Equipment Needed</i></p> <ul style="list-style-type: none"> ◆ Lesson plan. ◆ Samples of MSDSs from your site. ◆ Overhead projector ◆ Overhead slides made from paper copies at the end of Lesson Plan. ◆ Some blank overhead transparencies, for use as necessary. ◆ Marker, for writing on overhead transparencies ◆ Computer projector and laptop computer, if available. ◆ Handouts made from paper copies of overheads. ◆ Copies of <u>Glossary of Commonly Used Terms</u>. ◆ Screen. ◆ Video and video playback equipment, if needed. ◆ Copies of quiz. 	<p><i>Learning Objectives</i></p> <ul style="list-style-type: none"> ◆ Employees will recognize the concept of dose/response. ◆ Employees will recognize the 3 routes of entry (review). ◆ Employees will recognize acute vs. chronic effects. ◆ Employees will recognize the terms: “toxic and highly toxic chemicals,” “carcinogens,” “corrosives,” “irritants,” “sensitizers,” and “target organ effects,” and will locate them in the Glossary. ◆ Employees will identify 3 types of protective measures: engineering controls, work practices, and PPE (review).

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself	Slide No. 1:

Time (minutes)	Subject Outline	What to Do	Aids/Cue
		<u>Circulate</u> attendance sheet <u>Introduce</u> topic: Understanding Health Information	Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<u>State</u> the following course objectives: <ul style="list-style-type: none"> ◆ Employees will recognize the concept of dose/response. ◆ Employees will recognize the 3 routes of entry (review). ◆ Employees will recognize acute vs. chronic effects. ◆ Employees will recognize the terms: “toxic and highly toxic chemicals,” “carcinogens,” “corrosives,” “irritants,” “sensitizers,” and “target organ effect,” and will locate them in the Glossary. ◆ Employees will identify 3 types of protective measures: engineering controls, work practices, and PPE (review). 	Slides No. 2 2a and 2b: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Overview of lesson	<p><u>Remind</u> participants that the MSDS describes health effects of hazardous chemicals, and ways to prevent exposure.</p> <p><u>Describe</u> the need to learn new terms, so that employees can better understand hazards and how to protect themselves.</p> <p>On the overhead or PowerPoint slide, <u>fill in</u> with a marker other terms that employees may have had trouble understanding.</p>	Slide No. 3: Common terms found in the MSDS

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Note:	If you have a video about these concepts, show it now.		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Dose/response relationship	<p><u>Describe</u> the “dose” as the amount of a hazardous chemical that employees are exposed to.</p> <p><u>Describe</u> the “response” as the effect resulting from intake of a hazardous chemical into the body. Generally, the higher the dose, the greater the effect.</p> <p><u>Discuss</u> examples of substances that are harmless or helpful in small doses, but poisonous in large amounts. Aspirin is an example.</p> <p><u>Ask</u> the class for more examples.</p>	Slide No. 4: Dose/Response

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Exposure limits	<p><u>Review</u> previous material about exposure limits (from “Understanding the MSDS”).</p> <p><u>Show</u> that the terms “TLV” and “PEL” are in the Glossary.</p> <p><u>Describe</u> the concept of a “threshold.” This concept means that people can be exposed day after day up to a certain level without harm.</p> <p><u>Give an example</u> of a TLV from one of the MSDSs at your site.</p>	Slide No. 5: Exposure Limits

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Routes of entry	<p><u>Review</u> the routes of entry (from “Understanding the MSDS”).</p> <p><u>Link</u> the idea of the dose of a hazardous chemical to the routes of entry.</p> <p><u>Give an example</u> of a respiratory hazard, skin or eye contact hazard, or ingestion (swallowing) hazard from an MSDS at your site.</p>	Slide No. 6: Routes of Entry

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Acute effects	<p><u>Describe</u> an acute effect as one that happens suddenly, normally from a single exposure, as when an employee inhales a poisonous gas (for example, hydrogen sulfide) and falls unconscious, or when the eye or skin is exposed to a strong chemical irritant, such as an acid.</p> <p><u>Give an example</u> of a chemical substance that has a sudden or acute effect at your site.</p> <p><u>Ask</u> if participants can think of another example of a chemical substance that has a sudden or acute effect.</p>	Slide No. 7: Acute Effects

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Chronic effects	<p><u>Describe</u> chronic effects as those that do not happen suddenly. They are the result of repeated exposures over long periods of time, or when the body takes a long time to develop an adverse response, such as damage to the kidneys, some cancers, or nerve damage.</p> <p><u>Give an example</u> from an MSDS at your site.</p> <p><u>Ask</u> if participants can think of another example of a chemical substance that, after repeated doses, causes harm after a long period of time.</p>	Slide No. 8 and 8a: Chronic Effects

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Toxic and highly toxic chemicals	<p><u>State</u> that the word “toxic” means “poisonous.”</p> <p><u>State</u> that our knowledge of what is toxic is often derived from animal tests.</p> <p><u>Describe</u> the difference between “toxic” and “highly toxic” as representing the difference in test results when chemicals are administered to animals. For a highly toxic chemical, exposure to a smaller dose poisons more animals in a test group than from exposure to a toxic chemical. A small dose of a highly toxic chemical, such as phosgene, can be more dangerous than a larger dose of a less toxic chemical.</p> <p><u>Give an example</u> of a toxic and/or highly toxic chemical from one of your MSDSs.</p> <p><u>Give</u> participants the opportunity to look up the exact differences in the Glossary if they wish.</p>	Slide No. 9: Toxic/Highly Toxic

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Carcinogens	<p><u>Remind</u> participants that you discussed carcinogens (cancer-causing substances) in “Understanding the MSDS.”</p> <p><u>Link</u> the idea of “carcinogens” to the idea of “chronic effects.” Carcinogens usually cause cancer after repeated doses over long periods of time, or when the body takes a long time to develop an adverse response. An example is when asbestos fibers stay in the lung for a long period and after many years can cause asbestosis or cancer.</p> <p><u>Give an example</u> from an MSDS at your site. The common chemical benzene is a possible example.</p>	Slide No. 10: Carcinogens

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Corrosives	<p><u>Describe</u> a corrosive as a chemical that destroys or damages living tissue irreversibly by chemical action. Acids are corrosive. Another common example is lye.</p> <p><u>Give an example</u> of a corrosive from an MSDS at your work site.</p> <p><u>Link</u> the idea of corrosives to the need for skin and eye protection.</p>	Slide No. 11: Corrosives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Irritants	<p><u>Describe</u> an irritant as being less destructive to skin or eyes upon contact than a corrosive. The effect is reversible. For example, exposure to airborne dusts can cause eye irritation.</p> <p><u>Give an example</u> of an irritant from an MSDS at your site.</p> <p><u>Link</u> the idea to the need for skin and eye protection.</p>	Slide No. 12: Irritants

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Sensitizers	<p><u>Describe</u> sensitizers as chemicals that cause many people to develop allergic reactions after repeated exposures. Poison ivy is a good example. Nickel is a common example in an industrial setting.</p> <p><u>Give an example</u> of a sensitizer from an MSDS at your site.</p>	Slide No. 13: Sensitizers

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Target organ effects	<p><u>Explain</u> that some chemicals target certain organs or body systems. For example, hepatotoxins like carbon tetrachloride produce liver damage. Neurotoxins, such as mercury, cause damage to the nervous system. Lead is a common nephrotoxin that damages the kidneys.</p> <p><u>Link</u> this idea to the idea of “chronic” and “acute” exposures. Many target organ effects result from chronic exposures, but some, such as ketones that irritate the skin, are acute.</p> <p><u>Give an example</u> from an MSDS at your site.</p>	Slide No. 14: Target Organ Effects

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Controls	<p><u>Remind</u> participants that 3 types of protective measures were discussed in “Understanding the MSDS.” These were: engineering, work practices, and PPE.</p> <p><u>Discuss</u> controls as they relate to the recommendations given in MSDSs at your work site, and the relationships between hazards and controls.</p> <p>For example, <u>show</u> how ventilation is used to reduce exposures to airborne hazards.</p>	Slide No. 15: Controls

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary	<p><u>Summarize and review</u></p> <ul style="list-style-type: none"> ◆ dose/response ◆ routes of entry ◆ acute vs. chronic effects ◆ toxic/highly toxic ◆ carcinogens ◆ corrosives ◆ irritants ◆ sensitizers ◆ target organ effects ◆ controls <p><u>Emphasize</u> that an “appropriate hazard warning” should be provided for target organ effects.</p>	Slide No. 16: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show an overhead or slide of quiz items for group response.	Handouts of quiz, OR make overhead or slide of quiz for group response

Lesson E: Understanding Flammables and Combustibles

Lesson Plan Worksheet

Lesson Title: Understanding Flammables and Combustibles
Intended Audience: All employees in a work area who are at risk from flammables and combustibles
Prerequisite: Understanding the HCS; the MSDS; Labels; Health Information
Time Required: Varies. Some sections of the Lesson Plan, such as “flammable gases” or “flammable solids,” can be omitted if not pertinent to the work area. More time will be needed if a video is shown.

Materials and Equipment Needed

- ◆ Lesson plan.
- ◆ Samples of MSDS from your work area.
- ◆ Overhead projector.
- ◆ Overhead slides/paper copies at the end of Lesson Plan.
- ◆ Some blank overhead transparencies for use as necessary.
- ◆ Marker, for writing on overhead slides.
- ◆ Computer projector and laptop computer, if available.
- ◆ Handouts made from paper copies of overheads.
- ◆ Copies of Glossary of Commonly Used Terms and/or copies of Hazard Communication Standard.
- ◆ Screen.
- ◆ Video and video playback equipment, if needed.
- ◆ Copies of quiz (**Note:** Instructor will have to provide an MSDS for site-specific quiz item No. 3)

Learning Objectives

- ◆ Employees will recognize the meaning of the terms “flammable” and “combustible”
- ◆ Employees will differentiate between:
 - ◆ flammable aerosols
 - ◆ flammable gases
 - ◆ flammable liquids
 - ◆ combustible liquids
 - ◆ flammable solids
- ◆ For flammables/combustibles in their work area, employees will recognize:
 - ◆ physical hazards
 - ◆ health hazards
 - ◆ methods of detection
 - ◆ emergency and handling procedures
 - ◆ First Aid procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<p><u>Introduce</u> yourself.</p> <p><u>Circulate</u> attendance sheet.</p> <p><u>Introduce</u> topic: Understanding Flammables and Combustibles.</p>	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<p><u>State</u> the following course objectives:</p> <ul style="list-style-type: none"> ◆ Employees will recognize the meaning of the terms “flammable” and “combustible” ◆ Employees will differentiate between: <ul style="list-style-type: none"> ◆ flammable aerosols ◆ flammable gases ◆ flammable liquids ◆ combustible liquids ◆ flammable solids ◆ For flammables/combustibles in their work area, employees will recognize: <ul style="list-style-type: none"> ◆ physical hazards ◆ health hazards ◆ methods of detection <ul style="list-style-type: none"> ◆ emergency and handling procedures ◆ First Aid procedures 	Slides No. 2 and 2a: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Overview of lesson	<p><u>Discuss</u> the importance of being aware of the hazards of flammables and combustibles</p> <p><u>Remind</u> participants that the MSDS must always be consulted before dealing with new flammables or combustibles or in emergency situations.</p> <p><u>Discuss</u> or <u>show</u> the MSDSs for flammables and/or combustibles used or stored in this work area.</p> <p><u>Insert</u> names of these substances on overhead or Power Point slide.</p>	Slide No. 3: Overview

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Note: If you have a video about flammables and combustibles, show it now.			

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Definitions of flammables and combustibles	<p><u>Explain</u> that for a fire to occur, there must be:</p> <ul style="list-style-type: none"> ◆ fuel (the flammable/combustible substance) ◆ heat ◆ oxygen or an oxidizer ◆ chemical chain reaction <p><u>State</u> that a flammable is a material that is easily ignited and burns rapidly. In addition to the fire hazard, exposure to vapors from flammables can have serious health effects. A common flammable is gasoline.</p> <p><u>State</u> that a combustible is a substance capable of fueling a fire, but will not burn as readily as a flammable. A common combustible is wood.</p>	Slide No. 4: Definitions

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Types of flammables and combustibles	<p><u>Describe</u> types of flammables as aerosols, gases, liquids, or solids.</p> <p><u>Explain</u> that many substances are combustible, but there is a special category of combustible liquids.</p>	Slide No. 5: Types of Flammables and Combustibles

Time (minutes)	Subject Outline	What to Do	Aids/Cue
Instructor:	From this point on discuss only those types of flammables and/or combustibles found in this work area.		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable aerosol (omit if this hazard is not present in the work area)	<p><u>Describe</u> a flammable aerosol as an aerosol that yields a flame projection for more than 18” at full valve opening, or a flash back (a flame extending back to the valve) at any degree of valve opening.</p> <p><u>Show</u> one or more MSDS for any aerosol in the work area that meets this definition.</p> <p><u>Discuss</u> any incidents or concerns regarding flammable aerosols.</p>	Slide No. 6: Flammable Aerosol

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable gases (omit if this hazard is not present in the work area)	<p><u>Describe</u> a flammable gas as a compressed gas with:</p> <ul style="list-style-type: none"> ◆ lower explosive limit (LEL) at or below 13% by volume ◆ a flammability range greater than 12% regardless of the lower limit. <p><u>State</u> that the LEL and other flammability information is determined by the chemical manufacturer, and can be found on the MSDS.</p> <p><u>Remind</u> participants that terms such as “LEL” can be found in the Glossary.</p> <p><u>Show</u> an MSDS for a flammable gas.</p>	Slide No. 7: Flammable Gases

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable gases physical properties and hazards (omit if not pertinent)	<p><u>Explain</u> that gases:</p> <ul style="list-style-type: none"> ◆ expand several times their volume when released ◆ may be heavier than air, like butane or propane, and will settle in low areas ◆ may be lighter than air, like hydrogen or methane. ◆ The vapor density information on the MSDS will tell you whether it is heavier or lighter than air. If it is heavier than air, it will be more than 1.0. If it is lighter, it will be less than 1.0. ◆ do not always have an odor ◆ are often colorless ◆ are dangerous if the cylinders are damaged. Damaged valves may cause cylinders to “rocket.” <p><u>Discuss</u> flammable gases in the work area of particular concern because of physical properties and hazards.</p>	Slides No. 8 and 8a: Flammable Gases: Physical Properties and Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable gases: Health hazards (omit if not pertinent)	<p><u>Describe</u> all flammable gases as simple asphyxiants. This means they may displace oxygen to a level below that needed for normal body functions.</p> <p><u>Explain</u> that hydrogen sulfide is also toxic, with acute effects that can result in death.</p> <p><u>Discuss</u> any flammable gases of particular health concern in your work area.</p>	Slide No. 9: Flammable Gases: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable gases: Methods of detection (omit if not pertinent)	<p><u>Explain</u> that odors are often added to flammable gases to aid detection and, therefore, prevent injury.</p> <p><u>Caution</u> that, for some gases, the sense of smell can quickly become deadened.</p> <p><u>Explain</u> that large volumes of gas escaping often make a hissing sound.</p> <p><u>Describe</u> the use of soap solution to detect leaks.</p> <p><u>Explain</u> that health/safety professionals have several instruments to detect leaks of flammable gas, generally called air monitoring instruments. Some have specific names to do a particular job.</p> <p><u>Discuss</u> specific methods of detecting gas leaks in your work area.</p>	Slide No. 10: Flammable Gases: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	Flammable gases: Emergency and handling procedures (omit if not pertinent)	<p><u>Remind</u> participants to:</p> <ul style="list-style-type: none"> ◆ transport and store cylinders with valve cap on ◆ never drag or roll cylinders—use special hand carts. ◆ secure cylinders near the top with straps or chains ◆ keep cylinder upright ◆ keep hoses/connections tight and leak-free ◆ store oxygen and flammable gas cylinders separately ◆ if gas leaks: use adequate ventilation and respiratory protective equipment; turn off any ignition valve; shut off the main cylinder valve <p><u>Discuss</u> procedures for flammable gases in your work area, including emergency procedures.</p> <p><u>Focus</u> on procedures that have caused, or are likely to cause, problems.</p>	Slide No. 11: Flammable Gases: Emergency and Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable gases: First Aid procedures (omit if not pertinent)	<p><u>Explain</u> generic procedures in the event of an overexposure:</p> <ul style="list-style-type: none"> ◆ Inhalation: remove victim to fresh air. If unconscious, maintain an open airway. Restore breathing if necessary. Seek medical attention. ◆ Eyes: Hold eyelids open and flush eyes for 15 minutes with large quantities of water. Seek medical attention. ◆ Skin: Wash with large quantities of water. Seek medical attention. <p><u>Discuss</u> First Aid procedures recommended on the MSDSs in your work area.</p>	Slide No. 12: Flammable Gases: First Aid

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable liquids (omit if this hazard is not present in the work area)	<p><u>Describe</u> a flammable liquid as a substance with a flash point below 100°F (37-8°C). A flash point is the minimum temperature at which sufficient vapors are given off to support a flame when a source of ignition is present.</p> <p><u>Note</u> that in transportation, liquids are placarded as “flammable” if they have a flash point of less than 140°F.</p> <p><u>Show</u> an MSDS for a flammable liquid.</p>	Slide No. 13: Flammable Liquids

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable liquids: Physical properties and hazards (omit if not pertinent)	<p><u>Explain</u> that flammable liquids:</p> <ul style="list-style-type: none"> ◆ vaporize quickly at room temperature ◆ some are soluble in water (e.g., alcohols) ◆ some are insoluble in water (e.g., xylene). Some are soluble in organic solvents or in acids. ◆ have a variety of odors (e.g., acetone smells sweet) ◆ have a variety of colors, but are often clear ◆ most have a specific gravity less than 1; this means they will float on top of water ◆ vapors are heavier than air, and may settle in low areas ◆ react violently with oxidizers and halogen gases (e.g., chlorine, fluorene) <p><u>Discuss</u> any specific flammable liquids in the work area that are of particular concern because of physical properties and hazards.</p>	Slides No. 14 and 14a: Flammable Liquids: Physical Properties and Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Flammable liquids: Health hazards	<p><u>Explain</u> that in addition to flammability, flammable liquids can be health hazards:</p> <ul style="list-style-type: none"> ◆ skin contact - may cause reddening or drying. ◆ inhalation - may cause dizziness, nausea or headaches, or may irritate the respiratory tract. <p>In addition to general symptoms:</p> <ul style="list-style-type: none"> ◆ alcohols (flammable liquids, ending in -ol) - are mild irritants. Methanol, when swallowed, may cause blindness. ◆ ketones (flammable liquids ending in -one) - are slightly more toxic than alcohols. ◆ aliphatic hydrocarbons (flammable liquids ending in -ane, such as hexane) may cause excitement, stupor, confusion. ◆ amines (flammable liquids with names that have -amine, -amid, or -nitro, such as n-butylamine) can cause liver, lung and kidney damage. ◆ ethers (flammable liquids ending in -ether or -futan, such as anhydrous ether) may cause unconsciousness, pneumonia and death. ◆ aromatics (flammable liquids ending in -ene, such as benzene) may cause convulsions, coma and death. Some are suspected carcinogens. <p><u>Discuss</u> any flammable liquids that are of particular health concern in your work area.</p>	Slides No. 15 and 15a: Flammable Liquids: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable liquids: Methods of detection (omit if not pertinent)	<p><u>Explain</u> that all flammable liquids:</p> <ul style="list-style-type: none"> ◆ Have detectable odors, although the sense of smell may quickly become deadened. ◆ May cause tearing or redness of the eyes. ◆ May be felt on the skin as an initial splash of liquid. <p><u>Explain</u> that health/safety professionals have several instruments to detect leaks of flammable liquids called air monitoring instruments.</p> <p><u>Discuss</u> specific methods of detection recommended in the MSDSs in your work area.</p>	Slide No. 16: Flammable Liquids: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable liquids: Personal protective equipment (omit if not pertinent)	<p><u>Explain</u> that when working with flammable liquids:</p> <ul style="list-style-type: none"> ◆ wear an approved respirator as prescribed in the MSDS or where ventilation is inadequate. ◆ wear splash goggles and a full face shield, where necessary. ◆ wear solvent-resistant gloves as prescribed in the MSDS. ◆ wear a rubber apron, or, for larger quantities, a splash suit when working with open container of flammable liquids. <p><u>Discuss</u> the PPE recommended in MSDSs in your work area (You can check the recommendations for compliance with applicable OSHA or ANSI standards.)</p>	Slide No. 17: Flammable Liquids: PPE

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	Flammable liquids: Emergency and handling procedures (omit if not pertinent)	<p><u>Explain</u> these important points:</p> <ul style="list-style-type: none"> ◆ Remove all sources of ignition. ◆ Be certain area is well ventilated. ◆ Never pour or wash flammable liquids into sewers or drains. ◆ When transferring flammable liquids, ground containers. <p><u>Discuss</u> procedures for flammable liquids at your site, including emergency procedures.</p> <p><u>Focus</u> on procedures that have caused, or are likely to cause, problems.</p>	Slide No. 18: Flammable Liquids: Emergency and Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable liquids: First Aid procedures (omit if not pertinent)	<p><u>Explain</u> these generic procedures in the event of an overexposure:</p> <ul style="list-style-type: none"> ◆ inhalation: remove victim to fresh air. Rescuers should be equipped with proper PPE before attempting rescue. If unconscious, maintain an open airway. Seek medical attention immediately. ◆ eyes: hold open eyelids and flush eyes with water for 15 minutes. Seek medical attention immediately. ◆ skin: Immediately wash with soap and water, or waterless cleanser. Remove contaminated clothing. <p><u>Discuss</u> First Aid procedures recommended on the MSDSs in your work area.</p>	Slide No. 19: Flammable Liquids: First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Combustible liquids	<u>Explain</u> that combustible liquids have a higher flash point than flammable liquids, meaning that they will not burn as easily as flammables. It is at or above 100°F but below 200°F, as compared with the flash point below 100°F for flammable liquids.	Slide No. 20: Combustible Liquids

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable solids (omit if this hazard is not present in the work area)	<u>Describe</u> a flammable solid. It is any solid, other than explosives, that can cause a fire by self-ignition through: <ul style="list-style-type: none"> ◆ friction ◆ spontaneous chemical changes ◆ retained heat from manufacturing or processing ◆ reactivity with air or water <u>Show</u> an MSDS for a flammable solid in your work area.	Slide No. 21: Flammable Solids

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable solids: Physical properties and hazards (omit if not pertinent)	<p><u>Explain</u> that flammable solids:</p> <ul style="list-style-type: none"> ◆ burn readily and persistently ◆ may generate chemical products, from air or water reactivity, that are corrosive, poisonous or flammable ◆ require special extinguishing agents in a fire <p><u>Discuss</u> any specific flammable solids in the work area that are of particular concern because of physical properties and hazards.</p>	Slide No. 22: Flammable Solids: Physical Properties/Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Flammable solids: Health hazards (omit if not pertinent)	<p><u>Describe</u> all flammable solids as having potentially severe health effects:</p> <ul style="list-style-type: none"> ◆ alkali metals (sodium, lithium, potassium)—react with moisture on body to cause severe burns to skin, eyes, nose and throat. ◆ white phosphorus—reacts with air to form phosphoric acid, which is corrosive to eyes, skin, nose and throat. May affect the lungs. ◆ azides—many are toxic, causing a fall in blood pressure; some may inhibit enzyme action, resembling nitrites and cyanides. Most of the azide salts and acid can decompose explosively. Sensitive to heat, shock and friction. <p><u>Discuss</u> flammable solids of particular health concern in your work area.</p>	Slide No. 23: Flammable Solids: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Flammable solids: Methods of detection (omit if not pertinent)	<u>Explain</u> that if material begins to ignite, fume or bubble when exposed to air or water, evacuate to a safe distance immediately and notify emergency personnel.	Slide No. 24: Flammable Solids: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Flammable solids: Emergency and handling procedures (omit if not pertinent)	<u>Explain</u> that: <ul style="list-style-type: none"> ◆ for spills, if air or water reactive, evacuate personnel. ◆ for fire, notify emergency personnel. follow all written safety procedures.	Slide No. 25: Flammable Solids: Emergency and Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Flammable solids: First Air procedures (omit if not pertinent)	<p><u>Explain</u> these procedures in the event of an overexposure:</p> <ul style="list-style-type: none"> ◆ inhalation: remove to fresh air. Restore breathing if necessary. Seek medical attention immediately. ◆ eyes: hold eyelids open and flush eyes for 15 minutes with large quantities of water. Seek medical attention immediately. ◆ skin: immediately wash area with large quantities of cold water. Keep affected area cold. Seek medical attention immediately. ◆ ingestion (swallowing): seek medical attention immediately. <p><u>Discuss</u> First Aid procedures recommended on the MSDSs in your work area.</p>	Slide No. 26: Flammable Solids: First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary and review	<p><u>Summarize and review:</u></p> <ul style="list-style-type: none"> ◆ definition of flammables and combustibles ◆ types of flammables and combustibles (aerosols, gases, liquids, solids) ◆ for flammables and combustibles in your work area: <ul style="list-style-type: none"> ◆ physical properties and hazards ◆ health hazards ◆ methods of detection ◆ emergency and handling procedures ◆ First Aid procedures 	Slide No. 27: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<p><u>Hand out</u> or <u>speak</u> quiz items or <u>show</u> an overhead or PowerPoint slide of quiz for group response. Use only those quiz items pertinent to the flammables in your work area.</p>	Handouts of Quiz OR make overhead or slide of Quiz for group response.

Lesson F: Understanding Corrosives

Lesson Plan Worksheet

Lesson Title:	Understanding Corrosives
Intended Audience:	All employees in work area who are at risk from corrosives
Prerequisite:	Understanding the HCS; Understanding the MSDS; Understanding Labels; Understanding Health Information
Time Required:	35 to 40 minutes (longer if a video is shown)

<p>Materials and Equipment Needed</p> <ul style="list-style-type: none"> ◆ Lesson plan. ◆ Samples of MSDSs for corrosives from your site. ◆ Overhead projector. ◆ Overhead slides, made from paper copies at end of Lesson Plan. ◆ Some blank overhead transparencies for use as necessary. ◆ Marker, for writing on overhead transparencies ◆ Computer projector and laptop computer, if available ◆ Handouts made from paper copies of slides ◆ Copies of <u>Glossary of Commonly Used Terms and or HCS.</u> ◆ Screen. ◆ Video and video playback equipment, if needed. ◆ Copies of quiz. ◆ If possible, appropriate PPE for demonstration. 	<p>Learning Objectives</p> <ul style="list-style-type: none"> ◆ Employees will recognize the meaning of the term “corrosive.” ◆ When presented with a series of exposure signs and symptoms, employees will select those applicable to corrosives. ◆ For corrosives in their work area, employees will identify the First Aid procedures to follow when exposed to these corrosives. ◆ For corrosives in their work area, employees will identify the proper PPE and procedures for handling, spill and leak cleanup, and disposal of these corrosives.
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Time (minutes)	Subject Outline	What to Do	Aids/Cue
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Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself <u>Circulate</u> attendance sheet <u>Introduce</u> topic: Understanding Corrosives	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<u>State</u> the following course objectives: <ul style="list-style-type: none"> ◆ Employees will recognize the meaning of the term “corrosive.” ◆ When presented with a series of exposure signs and symptoms, employees will select those applicable to corrosives. ◆ For corrosives in their work area, employees will identify the First Aid procedures to follow when exposed to these corrosives. ◆ For corrosives in their work area, employees will identify the proper PPE and procedures for handling, spill and leak cleanup, and disposal of these corrosives. 	Slide No. 2: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Overview of lesson	<p><u>Remind</u> participants that corrosives were described in “Understanding Health Information” as chemicals that destroy or damage living tissue irreversibly.</p> <p><u>Explain</u> that corrosives, in the form of strong acids or strong caustics (bases), are widely used in industry. They are dangerous to the human body because they tend to dissolve body tissue. When in contact with the skin, they produce chemical burns. When corrosive mists are inhaled, they can damage the respiratory system.</p> <p><u>State</u> that the general uses for corrosives are in water treatment, chemical processes, and in storage batteries.</p>	Slide No. 3: Overview

Time (minutes)	Subject Outline	What to Do	Aids/Cue
NOTE:	If you have a video about corrosives, show it now.		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Physical characteristics	<p><u>State</u> that corrosives may be:</p> <ul style="list-style-type: none"> ◆ in solid, liquid, or gaseous form. ◆ may give off a corrosive mist when released in the air. ◆ usually soluble in water. ◆ normally non-flammable. 	Slide No. 4: Physical Characteristics

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	Health effects	<p><u>Explain</u> that:</p> <ul style="list-style-type: none"> ◆ Skin contact may result in burns, open sores, or scarring. At first, contact with acids usually produce an itching sensation. Some acids may give a burning sensation immediately. Contact with caustics will result in a soapy feeling. ◆ Eye contact can result in burns and serious damage. ◆ Inhalation can cause burns to the nose and throat, and cause lung damage. ◆ Ingestion can cause burns to the mouth, throat and stomach. It can also cause nausea and ulceration. ◆ Over a period of time, corrosives can cause bronchitis, inflammation of the eye, and digestive problems. <p><u>Discuss</u> health effects of concern in your area.</p>	Slides No. 5, 5a: Health Effects

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Methods of detection	<p><u>Explain</u> that initial detection may be from:</p> <ul style="list-style-type: none"> ◆ observation of spills or leaks ◆ eyes watering ◆ skin irritation <p><u>Discuss</u> methods of detection in this work area</p>	Slide No. 6: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	PPE	<p><u>Describe</u> and, if possible, <u>demonstrate</u> the use of appropriate PPE as recommended in the MSDS. These may include:</p> <ul style="list-style-type: none"> ◆ rubber apron ◆ rubber gloves ◆ splash goggles ◆ full face shield ◆ respirator with approved cartridge (if excessive airborne levels are anticipated) <p><u>Explain</u> the color-coded labels on approved cartridges for acids and caustics.</p> <p><u>Discuss</u> PPE issues and concerns in this work area.</p>	Slide No. 7: PPE

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00	First Aid procedures	<p><u>Explain</u> the following:</p> <ul style="list-style-type: none"> ◆ Refer to MSDS for specific instructions. ◆ Skin - flush with large quantities of cold water. Remove any contaminated clothing. Seek medical attention. ◆ Eyes - flush eyes for 15 minutes with large quantities of water. Seek medical attention. ◆ Inhalation - if overexposure or difficulty in breathing occurs, remove victim to fresh air. Restore breathing, if necessary. Seek medical attention. ◆ Ingestion (swallowing) - seek medical attention immediately. DO NOT INDUCE VOMITING. ◆ <u>Explain</u> that if you induce vomiting, the affected organs or systems will be burned again when vomiting occurs. <p><u>Discuss</u> any First Aid experiences with corrosives in this work area and any special instructions given on the MSDS.</p>	Slide No. 8: First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Spill, leak, and disposal procedures	<p><u>Explain</u> these procedures:</p> <ul style="list-style-type: none"> ◆ Refer to MSDS ◆ Wear appropriate PPE ◆ Neutralize spill, or use commercial spill cleanup kit, if such an action is consistent with your procedures developed for HAZWOPER compliance (29 CFR 1910.120). ◆ Place into suitable container, if consistent with the HAZWOPER procedures. ◆ Dispose of in accordance with local, State and Federal regulations <p><u>Discuss</u> any spills or leaks that may have occurred here.</p>	Slide No. 9: Spill, Leak and Disposal Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Summary	<p><u>Summarize and review</u></p> <ul style="list-style-type: none"> ◆ Corrosives destroy or damage living tissue irreversibly. ◆ Corrosives can be strong acids or strong caustics. ◆ Physical characteristics. ◆ Health effects from overexposure. ◆ Methods of detection. ◆ PPE ◆ First Aid procedures. ◆ Spill, leak and disposal procedures. 	Slide No. 10: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show a slide of quiz items for group response.	Handouts of quiz OR make slide of quiz for group response

Lesson G: Understanding Reactive Chemicals

Lesson Plan Worksheet

<p>Lesson Title: Understanding Reactive Chemicals</p> <p>Intended Audience: All employees in work area who are at risk from reactive chemicals</p> <p>Prerequisite: Understanding the HCS; Understanding the MSDS; Understanding Labels; Understanding Health Information</p> <p>Time Required: 40 to 45 minutes (longer if a video is shown)</p>	
<p><i>Materials and Equipment Needed</i></p> <ul style="list-style-type: none">◆ Lesson plan.◆ Samples of MSDSs for reactive chemicals from your site◆ Overhead projector.◆ Overhead slides, made from paper copies at end of Lesson Plan.◆ Some blank overhead transparencies, for use as necessary.◆ Marker, for writing on overhead transparencies.◆ Computer projector and laptop computer, if available.◆ Handouts made from paper copies of overheads.◆ Copies of <u>Glossary of Commonly Used Terms and/or HCS</u>.◆ Screen.◆ Video and video playback equipment, if needed.◆ Copies of quiz.◆ If possible, appropriate PPE for demonstration.	<p><i>Learning Objectives</i></p> <ul style="list-style-type: none">◆ Employees will recognize the meaning of the term “reactive chemicals.”◆ When presented with a series of effects of physical and health hazards, employees will select those applicable to reactive chemicals.◆ For reactive chemicals in their work area, employees will recognize:<ul style="list-style-type: none">◆ physical properties and hazards◆ health hazards◆ methods of detection◆ PPE◆ emergency and handling procedures◆ First Aid procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself <u>Circulate</u> attendance sheet <u>Introduce</u> topic: Understanding Reactive Chemicals	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<u>State</u> the following course objectives: Employees will recognize the meaning of the term “reactive chemicals.” <ul style="list-style-type: none"> ◆ When presented with a series of effects of physical and health hazards, employees will select those applicable to reactive chemicals. ◆ For reactive chemicals in their work area, employees will recognize: <ul style="list-style-type: none"> ◆ physical properties and hazards ◆ health hazards ◆ methods of detection ◆ PPE ◆ emergency and handling procedures ◆ First Aid procedures 	Slides No. 2, 2a: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Overview of lesson	<u>State</u> that reactive chemicals, other than blasting agents or explosives, are liable to cause fire through friction, absorption of moisture, spontaneous chemical changes or retained heat from manufacturing or processing <u>or</u> can be ignited readily and when ignited burn so vigorously and persistently as to create a serious hazard.	Slide No. 3: Overview

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Definitions	<p><u>Remind</u> participants who took part in the “Understanding Flammables and Combustibles” lesson that flammable solids are reactive chemicals.</p> <p><u>State</u> that, in addition to flammable solids, other reactive chemicals are oxidizers and organic peroxides. These materials readily yield oxygen, which may result in the ignition of combustible materials.</p> <p><u>State</u> that all these materials can also be a health hazard. However, their primary characteristic is reactivity and their ability to start or promote a fire or explosion.</p>	Slide No. 4: Definitions

Time (minutes)	Subject Outline	What to Do	Aids/Cue
NOTE	If you have a video about reactive chemicals, show it now.		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Reactive chemicals in the work area	<p><u>Show</u> an MSDS or MSDSs for reactive chemicals in this work area.</p> <p><u>Discuss</u> where reactive chemicals are used or stored.</p> <p><u>Fill in</u> chemical or common names on the overhead.</p>	Slide No. 5: Reactive chemicals in this work area (fill in chemical name(s) on overhead)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Physical properties and hazards	<p><u>State</u> that:</p> <ul style="list-style-type: none"> ◆ Reactive chemicals may be solids or liquids. ◆ They may be air or water reactive. ◆ Chemical products from air or water reactivity may be corrosive, poisonous or flammable. ◆ They may be shock, heat, or friction sensitive, and may result in a fire or an explosion when in contact with combustible materials. ◆ Oxidizers may react with metals to form hydrogen gas. 	Slide No. 6: Physical Properties and Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Physical properties and hazards (cont'd)	<p><u>State</u> that:</p> <ul style="list-style-type: none"> ◆ The majority of oxidizers are water soluble. ◆ Reactive chemicals require special extinguishing agents to extinguish the fire. <p><u>Discuss</u> concerns about physical properties and hazards in this work area.</p> <p><u>Stress</u> the importance of checking the manufacturer's recommendations in the MSDS.</p>	Slide No. 6a: Physical Properties and Hazards stet

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Health hazards	<p><u>State</u> that many reactive chemicals are corrosive and can destroy tissue. Overexposures may result in the following:</p> <ul style="list-style-type: none"> ◆ Alkali metals (sodium, lithium, potassium) react with body moisture to cause severe burns to skin, eyes, nose, throat. ◆ White phosphorus reacts with air to form phosphoric acid, which is severely corrosive. ◆ Azides may be poisonous, in addition to being unstable, sensitive to heat, shock and friction. 	Slide No. 7: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Health hazards (cont'd)	<p><u>State</u> that:</p> <ul style="list-style-type: none"> ◆ Hydrazines, which are oxidizers, may irritate eyes, skin and respiratory tract; are suspected carcinogens and mutagens (harmful to the gene pool). ◆ Nitrates may cause dizziness, vomiting, convulsions and death. ◆ Chlorates irritate the eyes, nose and respiratory tract. In confined spaces, free chlorine can cause asphyxiation and death. ◆ Metal peroxides can be irritating to the eyes, nose and respiratory tract. 	Slide No. 7a: Health Hazards (Cont'd)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Health hazards (cont'd)	<p><u>Discuss</u> concerns about health hazards in this work area.</p> <p><u>Discuss</u> methods of checking the MSDS.</p>	Slide No. 7b: Health Hazards (Cont'd)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Methods of detection	<p><u>Describe</u> these methods:</p> <ul style="list-style-type: none"> ◆ Sight - if material begins to ignite, fume or bubble when exposed to the air or water, immediately evacuate personnel to safe distance and notify emergency personnel. ◆ Smell - some oxidizers have odors (chlorates-chlorine) that may be detected. <p><u>Caution</u> that the sense of smell may be quickly deadened by even small amounts of gas.</p> <ul style="list-style-type: none"> ◆ Air monitoring - health professionals use specific monitoring equipment to detect leaks of reactive chemicals. <p><u>Discuss</u> methods of detection in this work area, as recommended in the MSDS.</p>	Slides No. 8, 8a: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	PPE	<p><u>State</u> that the handling of many reactive chemicals requires special equipment.</p> <ul style="list-style-type: none"> ◆ Gloves should be worn, since moisture from the skin may cause materials to react. ◆ Splash goggles and a full-face shield may be required to protect the eyes. ◆ Certain reactive chemicals require use of an air-supplied respirator or SCBA when handling the material. ◆ Fire-retardant or impervious clothing may be required for handling if a reaction has occurred. <p><u>Discuss</u> PPE requirements in this work area, as recommended in the MSDS.</p> <p>NOTE: See 29 CFR 1910.134 for more detailed information about respirators.</p>	Slides No. 9, 9a: PPE

Time (minutes)	Subject Outline	What to Do	Aids/Cue
23:00	Emergency and handling procedures	<p><u>State</u> that:</p> <ul style="list-style-type: none"> ◆ Spills - if air or moisture reactive, evacuate personnel. ◆ Fire - notify emergency personnel. If fire becomes larger or more violent, evacuate area. ◆ Follow all written safety procedures. <p><u>Discuss</u> emergency and handling procedures for this work area, as recommended in the MSDS.</p>	Slide No. 10: Emergency and Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	First Aid procedures	<p><u>Explain</u> the following procedures if overexposure occurs:</p> <ul style="list-style-type: none"> ◆ Skin - flush with large quantities of cold water. Keep affected area cold. ◆ Eyes - hold eyelids open and flush eyes for 15 minutes with large quantities of water. ◆ Inhalation - remove to fresh air. Restore breathing, if necessary. ◆ Ingestion (swallowing) - seek medical attention immediately. <p>ALL - Always seek medical help immediately.</p> <p><u>Review</u> the First Aid procedures for reactive chemicals in this work area, as recommended in the MSDS.</p>	Slide No. 11: First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary and review	<u>Summarize and review:</u> <ul style="list-style-type: none"> ◆ The meaning of “reactive chemical.” ◆ Types of reactive chemicals (flammable solid, oxidizer, organic peroxides). ◆ For reactive chemicals in the work area: <ul style="list-style-type: none"> ◆ physical properties and hazards ◆ health hazards ◆ methods of detection ◆ PPE ◆ emergency and handling procedures ◆ First Aid procedures 	Slide No. 12: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or <u>show</u> an overhead or slide of quiz items for group response.	Handouts of quiz OR make overhead/slide of quiz for group response

Lesson H: Understanding Toxic Chemicals

Lesson Plan Worksheet

<p>Lesson Title: Understanding Toxic Chemicals</p> <p>Intended Audience: All employees in work area who are at risk from toxic chemicals</p> <p>Prerequisite: Understanding the HCS; Understanding the MSDS; Understanding Labels; Understanding Health Information</p> <p>Time Required: 40 to 45 minutes (longer if a video is shown)</p>	
<p><i>Materials and Equipment Needed</i></p> <ul style="list-style-type: none"> ◆ Lesson plan. ◆ Samples of MSDS from your work area. ◆ Overhead projector. ◆ Overhead slides/paper copies at end of Lesson Plan. ◆ Some blank overhead transparencies for use as necessary. ◆ Marker, for writing on overhead transparencies. ◆ Computer projector and laptop computer, if available. ◆ Handouts made from paper copies of overheads. ◆ Copies of <u>Glossary of Commonly Used Terms and/or HCS</u>. ◆ Screen. ◆ Video and video playback equipment, if needed. ◆ Copies of quiz. ◆ If possible, appropriate PPE for demonstration. 	<p><i>Learning Objectives</i></p> <ul style="list-style-type: none"> ◆ Employees will recognize the difference between “toxic chemicals” and “carcinogens.” ◆ Employees will recognize the relationship between toxic chemicals and the dose/response concept. ◆ Employees will identify the hazard communication requirements for mixtures containing toxic chemicals (health hazards) and mixtures containing carcinogens. ◆ For toxic chemicals in their work area, employees will recognize: <ul style="list-style-type: none"> ◆ physical hazards ◆ health hazards ◆ methods of detection ◆ PPE ◆ emergency and handling procedures ◆ First Aid procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
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Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Introduction	<u>Introduce</u> yourself <u>Circulate</u> attendance sheet <u>Introduce</u> topic: Understanding Toxic Chemicals	Slide No. 1: Title slide

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Learning objectives	<u>State</u> the following course objectives: <ul style="list-style-type: none"> ◆ Employees will recognize the difference between “toxic chemicals” and “carcinogens.” ◆ Employees will recognize the relationship between toxic chemicals and the dose/response concept. ◆ Employees will identify the hazard communication requirements for mixtures containing toxic chemicals (health hazards) and mixtures containing carcinogens. ◆ For toxic chemicals in their work area, employees will recognize: <ul style="list-style-type: none"> ◆ physical hazards ◆ health hazards ◆ methods of detection ◆ PPE ◆ emergency and handling procedures ◆ First Aid procedures 	Slides No. 2, 2a: Learning Objectives

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Overview of lesson	<p><u>Remind</u> participants that “toxic” means “poisonous.” Toxic chemicals cause adverse health effects that can be either acute or chronic.</p> <p><u>Remind</u> participants that chemicals are often harmless in small doses. The size of the dose and the effect it has on the body (response) in animal studies and from human experience determine whether the chemical is called “toxic” or “highly toxic.”</p> <p><u>Remind</u> participants that “carcinogens” are toxic chemicals that cause cancer.</p>	Slide No. 3: Overview

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Definitions	<p><u>Remind</u> participants that the definition of “toxic,” “highly toxic” chemicals and “carcinogen” are in the HCS and also in the Glossary. An example of a toxic chemical is trichloroethylene. Phosgene is a highly toxic chemical.</p> <p><u>State</u> that toxic chemicals can cause acute or chronic health effects.</p> <p><u>State</u> that the term “carcinogen” may include substances that have multiple effects. Carcinogens may also be “teratogens (causing harm to the fetus if the worker is pregnant), and/or “mutagens” (causing harm to the genetic pool). Some substances can be teratogens or mutagens without being carcinogens.</p>	Slide No. 4: Definitions

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Definitions (cont'd)	<p><u>State</u> that chemical manufacturers and importers determine if substances are health hazards, and indicate the type and degree of hazard on the MSDS.</p> <p><u>State</u> that substances that we call “flammable/combustible,” “corrosive,” “reactive” can be toxic also. However, they have other primary characteristics that make them hazardous. These are flammability/combustibility, corrosivity, and reactivity. They are generally called “physical hazards.” There are separate Lesson Plans for these substances.</p>	Slide No. 5: Definitions (cont'd)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
1:00	Toxic chemicals/carcinogens in mixtures	<p><u>State</u> that chemical manufacturers/importers may test mixtures as a whole or, if they do not do this, state that the mixture is a health hazard if the components that make up 1% (one percent) of the mixture are a known health hazard.</p> <p><u>State</u> that the mixture is presumed to be a carcinogenic hazard if it contains carcinogenic components in concentrations of 0.1% (a tenth of one percent) or greater.</p>	Slide No. 6: Mixtures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
NOTE:	If you have a video about toxic chemicals, show it now.		

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Toxic chemicals in work area	<p><u>Discuss</u> or <u>show</u> MSDSs for toxic chemicals and/or carcinogens used or stored in this work area.</p> <p><u>Insert</u> names of chemical substances on overhead or slide (optional--if there are many, circulate a list or copies of the MSDSs).</p> <p><u>Remind</u> participants to check the MSDS for each substance for specific information.</p>	Slide No. 7: Toxic Chemicals and/or Carcinogens in Work Area (optional)

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Routes of entry	<p><u>Remind</u> participants that toxic/hazardous chemicals have three primary routes of entry into the body.</p> <p><u>Discuss</u> the routes of entry that are of concern for the toxic chemicals in this work area.</p>	Slide No. 8: Routes of Entry

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Physical hazards	<p><u>State</u> that physical properties vary widely, since many different substances are identified as toxic health hazards.</p> <p><u>Discuss</u> the physical properties of toxic chemicals that are of concern in this work area.</p>	Slide No. 9: Physical Properties

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Health hazards	<p><u>Remind</u> participants that in “Understanding Health Information” they learned many different types of health hazards, including target organ effects.</p> <p><u>Discuss</u> potential health hazards of toxic chemicals that are of concern in this work area.</p>	Slide No. 10: Health Hazards

Time (minutes)	Subject Outline	What to Do	Aids/Cue
2:00	Methods of detection	<p><u>State</u> that toxic chemicals vary widely in appearance, odor, and other characteristics. Health professionals use different monitoring instruments to detect and measure the levels of the many different types.</p> <p><u>Discuss</u> the methods of detection that are used for toxic chemicals in this work area.</p>	Slide No. 11: Methods of Detection

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	PPE	<p><u>Review</u> the PPE requirements for toxic chemicals in this work area.</p> <p><u>Link</u> PPE requirements to the concept of Routes of Entry.</p>	Slide No. 12: PPE

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	Emergency and handling procedures	<p><u>State</u> that emergency and handling procedures vary. Each MSDS advises on the proper procedures for each specific substance.</p> <p><u>Discuss</u> emergency and handling procedures for toxic chemicals in this work area.</p> <p><u>Review</u> any incidents, or potential incidents, involving emergency and/or handling problems.</p>	Slide No. 13: Emergency and Handling Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
3:00	First Aid procedures	<p><u>Review</u> the First Aid procedures for the toxic chemicals in this work area.</p> <p><u>Review</u> any specific incidents, or potential incidents, where First Aid has been an issue or problem.</p>	Slide No. 14: First Aid Procedures

Time (minutes)	Subject Outline	What to Do	Aids/Cue
4:00	Summary and review	<p><u>Summarize and review</u></p> <ul style="list-style-type: none"> ◆ Definitions of “toxic chemicals” and “carcinogens.” ◆ The dose/response concept. ◆ The hazard communication requirements for toxic chemicals and carcinogens in mixtures. ◆ For toxic chemicals in the work area: <ul style="list-style-type: none"> ◆ physical hazards ◆ health hazards ◆ methods of detection ◆ PPE ◆ emergency and handling procedures ◆ First Aid procedures 	Slides No. 15, 15a: Summary

Time (minutes)	Subject Outline	What to Do	Aids/Cue
5:00 to 10:00	Quiz	<u>Hand out</u> or <u>speak</u> quiz items, or show an overhead or slide of quiz items for group response.	Handouts of quiz OR make overhead or slide of quiz for group response

A.

**Understanding
the Hazard Communication
Standard (HCS)**

Purpose of HCS

“... to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees.”

Learning Objectives

- **Employees will identify the purpose of the HCS.**
- **Employees will recognize the five (5) main sections of the HCS.**
- **Employees will indicate how and where hazard communication information is available at their site.**
- **Employees will recognize who is responsible for HCS functions at their site.**

Who is responsible?

Name

- Identifying hazardous chemicals
- Preparing/implementing the written program
- In-plant labeling
- Labeling shipped containers
- Obtaining/maintaining MSDSs.
- Information and training programs.

Identification of Hazardous Chemicals

- **Manufacturers/importers evaluate their products.**
 - **If hazardous, an MSDS is prepared and sent to customers/purchasers.**
 - **If nonhazardous, chemicals are not covered by the HCS.**
 - **Hazardous chemicals can be found as --**
 - **liquids in containers**
 - **substances in pipes**
 - **chemicals generated in work operations**
 - **solids, gases, vapors**
- Where employees are potentially exposed.**

Elements of the Written Program

A “blueprint” for compliance, the written program contains descriptions of:

- staff responsibilities**
- labeling procedures**
- MSDS procedures (obtaining/maintenance)**
- information and training program**
- location/accessibility of all HCS elements**

Labels and Other Forms of Warning

- **Manufacturer must send labels with:**
 - **identity of chemical**
 - **appropriate hazard warning**
 - **name/address of manufacturer**
- **Identity of the chemical on the in-plant label must be linked to the name on the MSDS and the inventory list of chemicals.**
- **Labels, tags, placards, process sheets and markings on workplace containers must show:**
 - **identity of chemical**
 - **appropriate hazard warning**

Material Safety Data Sheets

- **A detailed document sent by the manufacturer/importer. Designed to communicate hazard information to:**
 - **employers**
 - **employees**
 - **health professionals**
 - **emergency personnel**
- **Always available/accessible to employees.**

Information and training:

- **Employees must be informed of:**
 - **requirements of the HCS**
 - **operations in work area where there are hazardous chemicals**
 - **location/availability of written program**

- **Employees must be trained in:**
 - methods/observations to detect presence/release of hazardous chemicals
 - physical and health hazards of chemicals in the work area
 - how to protect themselves
 - details of the hazard communication program

Summary:

This session covered:

- **purpose of HCS**
- **5 major sections:**
 - **identification of hazardous chemicals**
 - **written program**
 - **labels and other forms of warning**
 - **MSDSs**
 - **information and training**

B.

**Understanding the Material
Safety Data Sheet**

Learning Objectives

- ◆ **Employees will recognize the purpose of the MSDS.**
- ◆ **Employees will identify key requirements of the MSDS.**
- ◆ **Using a glossary, employees will look up common terms used in MSDSs.**
- ◆ **Employees will state where MSDSs are located in their work area.**

An MSDS

Purpose of the MSDS

Provides detailed information about chemical hazards to:

- **Employees**
- **Employers**
- **Health professionals**
- **Emergency personnel**

Requirements

**Identity Used on the Label -- Chemical or
Common Name:**

**At this site, one of the chemicals
commonly used is**

Article III.

Article IV. Requirements

1. Physical and
2. Chemical Characteristics:

This information is useful to emergency personnel. It answers questions such as:

- ◆ What is the vapor pressure?
- ◆ What is the flash point?

Requirements

Physical Hazards:

This information answers these questions:

- ◆ What is the potential fire hazard?**
- ◆ What is the potential explosion hazard?**
- ◆ What is the potential danger of chemical reactions?**

Requirements

Health Hazards:

This information answers these questions:

- ◆ **What are the signs and symptoms of overexposure?**
- ◆ **What medical conditions may be aggravated by exposure to the chemical?**

Requirements

Routes of Entry:

This information answers these questions:

- ◆ **Is it hazardous to breathe the chemical in?**
- ◆ **Will the chemical cause irritation, burning or any other damage to the skin or eyes upon contact?**
- ◆ **Is it hazardous to swallow the chemical?**

Requirements

Exposure Limits:

This information is very useful to health professionals and employers when they plan how to best protect employees.

- ◆ PEL (permissible exposure limit)
- ◆ TLV (threshold limit value)

At this site, we have a PEL/TLV of _____
for the chemical _____

Requirements

Carcinogens/Potential Carcinogens:

“Carcinogen” means “has been shown to, or may potentially, cause cancer in animals or humans.”

Requirements

Carcinogens/Potential Carcinogens: (Cont'd)

The chemical manufacturer or importer finds out if a chemical is a carcinogen from:

- ◆ NTP (National Toxicology Program)**
- ◆ IARC (International Agency for Research on Cancer)**
- ◆ OSHA (Occupational Safety and Health Administration)**

Requirements

Safe Handling Procedures:

This information answers the questions:

- ◆ What hygienic practices should be followed?**
- ◆ What protective measures should be used when handling or storing the chemical or repairing and maintaining contaminated equipment?**
- ◆ What are the safe procedures for cleaning up spills and leaks?**

Requirements

Controls:

This information includes all that the employer and employee do to prevent overexposure.

- ◆ Engineering controls**
- ◆ Work practices**
- ◆ Personal protective equipment**

Requirements

Emergency and First Aid Procedures:

This information is useful in the event of an emergency or overexposure. It tells everybody what to do, such as:

- ◆ steps to follow if overexposure/contact occurs**
- ◆ how to control a spill**
- ◆ what kind of fire extinguisher to use**
- ◆ special First Aid instructions**

Requirements

Identity of Responsible Party

Date of Preparation

In case more information than provided on the MSDS is needed, the person responsible for the MSDS must provide:

- ◆ **Name**
- ◆ **Address**
- ◆ **Phone number**
- ◆ **Date of preparation**

Summary

This session covered:

- ◆ **Purpose of MSDS**
- ◆ **The key requirements**
- ◆ **Where to find the MSDSs at this site**

C.

Understanding Labels

Learning Objectives

- ◆ **employees will recognize the purpose of labels**
- ◆ **employees will identify the 3 key requirements of labels under the HCS**
- ◆ **employees will identify the hazard indicated on a label**

Purpose of Labels and Other Forms of Warning

Manufacturers, suppliers and importers must label containers of chemicals. They are intended as an *IMMEDIATE HAZARD WARNING*.

Requirements

- ◆ **Name of hazardous chemical, as it appears on the MSDS and chemical list**
- ◆ **Appropriate hazard warning in English**
- ◆ **Name and address of the manufacturer, importer, or supplier**

Sample label

Sample label

Requirements

Labels on Incoming Containers:

- ◆ **Must not be destroyed, removed or defaced**
- ◆ **Unless replaced with another label containing the required information**

Requirements

Stationary Containers and Vessels:

- ◆ **Name of substance**
- ◆ **Warning**

Requirements

Transfer containers:

- ◆ **Chemicals transferred from a larger container - Must be labeled if not used within one work shift**

Exceptions

- ◆ pesticides
- ◆ TSCA-regulated substances
- ◆ food, food additives and veterinary devices
- ◆ distilled spirits for non-industrial use
- ◆ consumer products
- ◆ agricultural or vegetable seed

Labeling and Placarding Systems

ANSI

NFPA

HMIS

DOT

Labeling and Placarding Systems (Cont'd)

DOT Placards

Like DOT labels, these use:

- ◆ graphics**
- ◆ words**
- ◆ UN identification system**
- ◆ color coding**

Summary

- ◆ Labels give an ***IMMEDIATE HAZARD WARNING***
- ◆ Incoming labels must show:
 - chemical name
 - hazard warning
 - name/address of manufacturer, importer or supplier
- ◆ At this site,

D. Understanding Health Information

Learning Objectives

Employees will:

- ◆ **recognize the concept dose/response**
- ◆ **identify the 3 routes of entry**
- ◆ **recognize “acute” vs. “chronic” effects**

Learning Objectives (cont'd)

Employees will recognize the terms:

- **toxic/highly toxic**
- **carcinogens**
- **corrosives**
- **irritants**
- **sensitizers**
- **target organ effects**

Learning Objectives (cont'd)

Employees will identify 3 types of protective measures:

- **engineering controls**
- **work practices**
- **PPE**

Common terms found in the MSDS

Many may be new to us, such as:

- ◆ **TLV**
- ◆ **target organ effects**
- ◆ **acute**

We can look new terms up in the Glossary.

Dose/Response

The higher the dose – the greater the effect.

Exposure Limits

- ◆ **PELs, TLVs and other dose limits that set thresholds.**
- ◆ **Designed to protect against adverse health effects.**

Routes of Entry

- ◆ **breathing in (inhalation)**
- ◆ **contact with skin (absorption)**
- ◆ **swallowing (ingestion)**

Acute Effects

- ◆ **happen suddenly, normally from a single exposure**
- ◆ **a possible acute effect here is**

Chronic Effects

- ◆ **repeated exposures over long periods of time**
- ◆ **or when the body takes a long time to develop a response after a brief exposure**

Chronic Effects (cont'd)

◆ a possible chronic effect here is

Toxic/Highly Toxic

- ◆ “toxic” = “poisonous”
- ◆ highly toxic -- smaller dose causes greater effect
- ◆ a toxic or highly toxic substance here is

Carcinogens

- ◆ cancer causing, or potentially cancer causing chemicals
- ◆ usually associated with chronic exposures
- ◆ a possible carcinogen here is

Corrosives

- ◆ destroy or damage living tissue
- ◆ effect is irreversible (no return to normal)
- ◆ a corrosive chemical here is

Irritants

- ◆ less destructive than corrosives
- ◆ effect is reversible (returns to normal)
- ◆ an irritant here is

Sensitizers

- ◆ may cause allergic reactions
- ◆ after repeated exposures
- ◆ a sensitizer here is

Target Organ Effects

- ◆ hepatotoxins --- liver
 - ◆ nephrotoxins --- kidney
 - ◆ neurotoxins --- nervous system
 - ◆ cutaneous hazards --- skin
 - ◆ a chemical that has a target organ effect here is:
-
-
-

Protective Measures

- ◆ engineering controls
- ◆ work practices
- ◆ PPE
- ◆ a protective measure used here is:

Summary:

- **dose/response**
- **routes of entry**
- **acute vs. chronic**
- **toxic/highly toxic**
- **carcinogens**
- **corrosives**
- **irritants**
- **sensitizers**
- **target organ effects**
- **controls**

E.

Understanding Flammables and Combustibles

Learning Objectives

- ◆ **Employees will recognize the meaning of the terms “flammable” and “combustible”**
- ◆ **Employees will differentiate between:**
 - **flammable aerosols**
 - **flammable gases**
 - **flammable liquids**
 - **combustible liquids**
 - **flammable solids**

Learning Objectives (Cont'd)

For flammables/combustibles in their work area, employees will recognize:

- **physical hazards**
- **health hazards**
- **methods of detection**
- **emergency and handling procedures**
- **First Aid procedures**

Overview

- ◆ Important to be aware of fire and health hazards of flammables and combustibles.
- ◆ Always refer to MSDS
- ◆ In this work area, we have the following flammables/combustibles

Definitions

- ◆ **Flammables are easily ignited and burn rapidly.**
- ◆ **Combustibles are substances capable of fueling a fire, but do not ignite and burn as readily as a flammable.**

Types of Flammables and Combustibles

Flammables

◆ aerosols

◆ liquids

◆ gases

◆ solids

Combustibles

◆ liquids

Flammable Aerosol

◆ **Flame projection of more than 18” at full valve**

OR

◆ **Flash back at any degree of valve opening**

Flammable Gases.

Compressed Gases

- ◆ LEL at or below 13%
- ◆ Flammability range greater than 12%

In this area, we have these compressed gases:

Flammable Gases.

Physical Properties/Hazards

- ◆ may expand several times the original volume when released
- ◆ may be heavier than air—settle in low area
- ◆ may be lighter than air
- ◆ do not always have an odor

Flammable Gases.

Physical Properties/Hazards (Cont'd)

- ◆ are usually colorless
- ◆ dangerous if cylinder is damaged—can “rocket”

Here, we are concerned about the properties/hazards of these flammable gases:

Flammable Gases.

Health Hazards

- ◆ all are simple asphyxiants
- ◆ some are toxic

Here, we are concerned about the health hazards of these gases:

Flammable Gases.

Methods of Detection

- ◆ odors (sense of smell sometimes deadened)
- ◆ sound (hissing)
- ◆ soap solution for leak detection
- ◆ air monitoring instruments

In this area, these methods of detection are recommended:

Flammable Gases.

Emergency and Handling Procedures

- ◆ transport/store with valve cap on
- ◆ **NEVER** drag or roll cylinders
- ◆ secure with straps or chains
- ◆ keep cylinders upright

Flammable Gases.

Emergency and Handling Procedures (Cont'd)

- ◆ **keep hoses and connections tight and leak-free**
- ◆ **store oxygen and flammable gas cylinders separately**
- ◆ **if gas leaks:**
 - **use adequate ventilation and PPE**
 - **turn off ignition sources**
 - **shut off main cylinder valve**

Flammable Gases.

First Aid

◆ Inhalation:

- move victim to fresh air
- maintain open airway
- restore breathing if needed
- seek medical help

◆ Eyes:

- flush 15 minutes
- seek medical help

◆ Skin: wash with large amounts of water. If skin is irritated or reddened, seek medical help.

Flammable Liquids

◆ flash point below 100°F

◆ in transportation, flash point below 140°F

Here, we have these flammable liquids:

Flammable Liquids.

Physical Properties/Hazards

- ◆ **vaporize quickly at room temperature**
- ◆ **some soluble in water**
- ◆ **some insoluble in water, but soluble in other substances**
- ◆ **many different odors**
- ◆ **different colors; often clear**

Flammable Liquids.

Physical Properties/Hazards (Cont'd)

- ◆ **most have specific gravity less than 1: will float on top of water**
- ◆ **vapors are heavier than air; may settle in low areas**
- ◆ **react violently with oxidizers and halogen gases**

Flammable Liquids.

Health Hazards

- ◆ **inhalation—may cause dizziness, nausea, headaches**
- ◆ **skin—may cause reddening, drying**

In addition to general symptoms:

- ◆ **alcohols (-ol) are mild irritants**
- ◆ **ketones (-one) slightly more toxic**

Flammable Liquids.

Health Hazards (Cont'd)

- ◆ **aliphatic hydrocarbons (-ane) may cause excitement, stupor, confusion**
- ◆ **amines (-amine, -amid, or -nitro) may cause liver, lung, and kidney damage**
- ◆ **ethers (-ether, -furan) may cause unconsciousness, pneumonia, and death**
- ◆ **aromatics (-ene) may cause convulsions, coma, and death. Some are suspected carcinogens**

Flammable Liquids.

Methods of Detection

- ◆ detectable odors
- ◆ tearing or redness of the eyes
- ◆ splash of liquid on skin
- ◆ air monitoring instruments

In this area, these methods of detection are recommended:

Flammable Liquids.

PPE

- ◆ approved respirator, as prescribed
- ◆ splash goggles and full face shield, as needed
- ◆ solvent - resistant gloves (selection based on liquid)
- ◆ rubber apron/splash suit for larger quantities in open containers

In this area, the recommended PPE is:

Flammable Liquids.

Emergency and Handling Procedures

- ◆ remove all ignition sources
- ◆ ventilate area
- ◆ **NEVER** pour down sewers/drains
- ◆ ground containers when transferring flammable liquids

Flammable Liquids.

First Aid

◆ Inhalation:

- move victim to fresh air
- rescuers should use proper PPE
- if unconscious, maintain open airway
- seek medical help

◆ Eyes:

- flush 15 minutes
- seek medical help

◆ Skin:

- wash with soap and water, or waterless cleanser
- remove contaminated clothes

Combustible Liquids

- ◆ **higher flash point than flammable liquids**
 - **at or above 100°F**
 - **below 200°**
- ◆ **ignite less readily than flammable liquids**

Flammable Solids

Can cause a fire by self-ignition through:

- ◆ **friction**
- ◆ **spontaneous chemical changes**
- ◆ **retained heat**
- ◆ **reactivity with air or water**

Flammable Solids.

Physical Properties/Hazards

- ◆ burn readily and persistently
- ◆ chemical products from reactivity may be corrosive, poisonous, or flammable
- ◆ require special fire extinguishing agents

Here, we are concerned about the properties and hazards of:

Flammable Solids.

Health Hazards

- ◆ alkali metals - severe burns
- ◆ azides: - many are toxic
 - some inhibit enzyme action
 - can decompose explosively
 - sensitive to heat, shock, and friction

Here, we are concerned about the following health hazards:

Flammable Solids.

Methods of Detection

If material ignites, fumes or bubbles when exposed to air or water:

- ◆ evacuate to safe distance**
- ◆ notify emergency personnel**

Flammable Solids.

Emergency and Handling Procedures

- ◆ for spills, if reactive to air or water, evacuate personnel
- ◆ for fire, notify emergency personnel

Follow all written safety procedures.

Flammable Solids.

First Aid

◆ Inhalation:

- move victim to fresh air
- restore breathing if necessary

◆ Eyes - flush 15 minutes

◆ Skin: wash with large amounts of water. Keep affected area cold.

◆ Ingestion (swallowing) - seek medical attention.

ALL: Seek medical help

Summary

- ◆ flammables - easily ignited; burn easily
 - ◆ combustibles - capable of fueling a fire; not as ignitable as flammables.
 - ◆ types of flammables (aerosols, gases, liquids, solids); combustible liquids
 - ◆ in this work area, we know the:
 - _____ physical hazards
 - _____ health hazards
 - _____ methods of detection
 - _____ emergency/handling procedures
 - _____ First Aid procedures
- of the flammables and combustibles.

F.

Understanding Corrosives

Learning Objectives

- ◆ **Employees will recognize the meaning of the term “corrosives.”**
- ◆ **When presented with overexposure signs and symptoms, employees will select those applicable to corrosives.**

Learning Objectives (cont'd)

- ◆ **For corrosives in the work area, employees will identify the correct First Aid procedures. For corrosives in the work area, employees will identify the proper PPE and procedures for handling, spill and leak cleanup, and disposal of these corrosives.**

Overview

Corrosives

- ◆ **destroy or damage living tissue irreversibly.**
- ◆ **can be strong acids, or strong caustics.**
- ◆ **can produce chemical burns.**
- ◆ **when inhaled as a mist, can damage respiratory system.**

Physical Characteristics

- ◆ **May be solid, liquid or gaseous.**
- ◆ **May give off a corrosive mist when released into air.**
- ◆ **Usually soluble in water.**
- ◆ **Normally non-flammable.**

Health Effects

Acute:

- ◆ **Skin - may burn**
 - **acids may produce itching or burning sensation**
 - **caustics may feel soapy**
- ◆ **Eyes - may burn or be damaged seriously.**

Health Effects (Cont'd)

- ◆ **Inhalation - may burn nose, throat and/or cause lung damage.**
- ◆ **Ingestion (swallowing) - may burn mouth, throat, stomach.**

Chronic: can cause bronchitis, eye inflammation, digestive problems.

Methods of Detection

- ◆ **Observation of spills or leaks**
- ◆ **Eyes watering**
- ◆ **Skin irritation**

PPE

May include:

- ◆ **rubber apron**
- ◆ **rubber gloves**
- ◆ **splash goggles**
- ◆ **full face shield**
- ◆ **respirator with approved cartridge**

Here, we need:

First Aid Procedures

◆ Refer to MSDS

◆ Skin -

- Flush with water for 15 minutes.**
- Remove contaminated clothing**
- Seek medical help.**

◆ Eyes -

- Flush with water for 15 minutes.**
- Seek medical help.**

First Aid Procedures (Cont'd)

◆ Inhalation -

- Remove victim to fresh air.**
- Restore breathing if necessary.**
- Seek medical help.**

◆ Ingestion (swallowing)

- Seek medical help IMMEDIATELY**

DO NOT INDUCE VOMITING.

Spill, Leak, Disposal Procedures

- ◆ **Refer to MSDS.**
- ◆ **Wear proper PPE.**
- ◆ **Neutralize spill and place in suitable container, if according to Emergency Response plans.**
- ◆ **Dispose, in accordance with regulations.**

Summary

- ◆ **corrosives destroy/damage living tissue irreversibly.**
- ◆ **can be strong acids or strong caustics.**
- ◆ **health effects are serious - can burn skin, eyes, respiratory system, and digestive system.**
- ◆ **methods of detection - observe spills, leaks and symptoms of overexposure**

Summary (Cont'd)

- ◆ **PPE - refer to MSDS**
- ◆ **First Aid - refer to MSDS. Seek medical help. DO NOT INDUCE VOMITING if swallowed.**
- ◆ **Spill, leak, disposal procedures. Refer to MSDS.**

G.

Understanding Reactive Chemicals

Learning Objectives

- ◆ **Employees will recognize the meaning of the term “reactive chemicals.”**
- ◆ **When presented with a series of effects of physical and health hazards, employees will select those applicable to reactive chemicals.**

Learning Objectives (Cont'd)

- ◆ **For reactive chemicals in their work area, employees will recognize:**
 - **physical properties and hazards**
 - **health hazards**
 - **methods of detection**
 - **PPE**
 - **emergency and handling procedures**
 - **First Aid procedures**

Overview

Reactive chemicals can cause fire through:

- ◆ **friction**
- ◆ **absorption of moisture**
- ◆ **spontaneous chemical changes**
- ◆ **retained heat**

OR

- ◆ **can be ignited readily, and burn so vigorously as to create a serious hazard.**

Definitions

Reactive chemicals' primary characteristic is to start or promote a fire. They include:

- ◆ flammable solids**
- ◆ oxidizers**
- ◆ organic peroxides**

These chemicals also have health hazards.

Reactive Chemicals in This Work Area

In this area, we use or store the following reactive chemicals:

Physical Properties and Hazards

- ◆ **may be solids or liquids.**
- ◆ **may be air or water reactive.**
- ◆ **chemical products from air/water reactivity may be corrosive, poisonous, and flammable.**
- ◆ **may be shock, heat or friction sensitive.**
- ◆ **may result in explosion, when in contact with combustible materials.**
- ◆ **oxidizers may react with metals to form hydrogen gas.**

Physical Properties and Hazards (Cont'd)

- ◆ majority of oxidizers are water soluble.
- ◆ reactive chemicals require special extinguishing agents to extinguish the fire.

In this work area, we are concerned about these physical properties/hazards:

Health Hazards

Many reactive chemicals are corrosive:

- ◆ ***alkali metals* react with body moisture to cause severe burns.**
- ◆ ***white phosphorus* reacts with air to form phosphoric acid—severely corrosive.**
- ◆ ***azides* are unstable, may be poisonous.**

Health Hazards Cont'd)

- ◆ **hydrazines may irritate eyes, skin and respiratory tract. Suspected carcinogens and mutagens.**
- ◆ **nitrates may cause dizziness, convulsions, death.**
- ◆ **chlorates irritate eyes, nose, respiratory tract.**
- ◆ **metal peroxides can irritate eyes, nose, respiratory tract**

Health Hazards Cont'd)

In this work area, we are concerned about these health hazards:

Methods of Detection

- ◆ **Sight - if material ignites, fumes or bubbles, evacuate to safe distance; notify emergency personnel.**
- ◆ **Smell - some have odors, but sense of smell may be quickly deadened.**
- ◆ **Air monitoring instruments.**

Methods of Detection (Cont'd)

In this work area, we use the following methods of detection:

PPE

May require special equipment:

- ◆ **gloves**
- ◆ **splash goggles and full face shield**
- ◆ **air supplied respirator or self-contained breathing apparatus (SCBA)**
- ◆ **fire-retardant or chemical-resistant clothing**

PPE (Cont'd)

For the chemicals in this area, the following PPE is recommended:

Section 5.01 _____

Emergency and Handling Procedures

- ◆ **spills - if air or moisture reactive, evacuate.**
 - ◆ **fire - notify emergency personnel. If fire becomes violent, evacuate area.**
 - ◆ **Follow all written safety procedures.**
- In this work area, we have the following procedures:**

First Aid Procedures

- ◆ **Skin - flush with large quantities of cold water. Keep affected area cold.**
- ◆ **Eyes - flush for 15 minutes with large quantities of water.**
- ◆ **Inhalation (breathing) - remove to fresh air. Restore breathing if necessary.**
- ◆ **Ingestion (swallowing) - seek medical help immediately.**

ALL - always seek medical help immediately.

Summary

- ◆ **reactive chemicals are likely to cause fire - can self-ignite.**
- ◆ **include flammable solids, oxidizers, organic peroxides.**
- ◆ **In this work area, we know the**
 - **physical properties and hazards**
 - **health hazards**
 - **methods of detection**
 - **PPE**
 - **emergency/handling procedures**
 - **First Aid procedures****- for reactive chemicals.**
- ◆ **always check the MSDS.**

H. Understanding Toxic Chemicals

Learning Objectives

- ◆ **Recognize differences between “toxic chemicals” and “carcinogens.”**
- ◆ **Recognize relationship between toxic chemicals and dose/response concept.**

Identify requirements for toxic chemicals (health hazards) and carcinogens in mixtures.

Learning Objectives (Cont'd)

- ◆ **Identify requirements for toxic chemicals (health hazards) and carcinogens in mixtures.**
- ◆ **For toxic chemicals in the work area, recognize:**
 - **physical hazards**
 - **health hazards**
 - **methods of detection**
 - **PPE**
 - **emergency/handling procedures**
 - **First Aid procedures**

Overview

- ◆ Toxic = poisonous, either acute or chronic
- ◆ Carcinogens = cancer-causing chemicals.
- ◆ Can be harmless in small doses.
- ◆ The higher the dose, the greater the effect on the body.
- ◆ Highly toxic - smaller dose poisons more animals in test group.

Definitions

- ◆ Toxic chemicals can cause acute or chronic health effects.
- ◆ Some chemicals are one or more of the following:
 - carcinogens - cancer-causing
 - teratogens - harm to the fetus
 - mutagens - harm to the gene pool

Definitions (cont'd)

- ◆ **Chemical manufacturers/importers determine if substances are health hazards, and show type and degree of hazard on MSDS.**
- ◆ **Physical hazards:**
 - **Flammables/combustibles**
 - **Corrosives**
 - **Reactive chemicals**

Can be toxic as well.

Mixtures

Mixtures, if not tested as a whole, are called a health hazard -

- ◆ if 1% of components are a known health hazard.**
- ◆ if 0.1% of components are known or suspected carcinogens.**

Toxic Chemicals and/or Carcinogens in Work Area

In this work area, we use or store the following toxic chemicals and/or carcinogens:

Routes of Entry

- ◆ breathing in (inhalation)
- ◆ contact with skin (absorption)
- ◆ swallowing (ingestion)

In this work area, we are concerned with these routes of entry:

Physical Properties

In this work area, we are concerned about the following physical properties:

Health Hazards

In this work area, we are concerned about the following potential health hazards:

Methods of Detection

The methods of detection recommended for toxic chemicals in this work area are:

PPE

PPE requirements for toxic chemicals in this work area are:

Emergency and Handling Procedures

Emergency and handling procedures for toxic chemicals in this work area are:

First Aid Procedures

First Aid procedures for toxic chemicals in this work area are:

Summary

- ◆ **toxic chemicals cause adverse acute or chronic health effects**
- ◆ **carcinogens are cancer-causing chemicals**
- ◆ **the larger the dose, the greater the effect.**
- ◆ **mixtures are health hazards if:**
 - **1% of mixture consists of toxic chemicals**
 - **0.1% of mixture consists of carcinogens**

Summary (cont'd)

- ◆ **For the toxic chemicals in this work area, we know where to find the:**
 - **Physical hazards**
 - **PPE requirements**
 - **Health hazards**
 - **Emergency/handling procedures**
 - **Methods of detection**
 - **First Aid procedures**

APPENDIX E

QUIZES

Name: _____

A. Understanding the Hazard Communication Standard:

1. The purpose of the Hazard Communication Standard (HCS) is: (check one)
 to protect employees from slips, trips and falls
 to communicate information about hazardous chemicals to employees
 to conduct a confined space entry program

2. The five main sections of the HCS are: (check 5)
 identifying hazardous chemicals
 selecting safety shoes
 written hazard communication program
 labels and other forms of warning
 physical exams
 material safety data sheets
 incident reporting
 information and training

3. At our site, the written program is available at _____

MSDSs are available at _____

4. The person responsible for HCS activities is _____

B. Understanding Material Safety Data Sheets:

1. The purpose of the Material Safety Data Sheet (MSDS) is: (check one)
- to provide detailed information about chemical hazards to employees, employers, health professionals and emergency personnel
- to provide marketing information to salesmen and customers
- to be fixed to containers as a short summary of hazards
2. There are several key requirements for MSDSs. Below, check all that apply:
- identity used on the label.
- physical and chemical characteristics.
- physical hazards.
- routes of entry.
- health hazards.
- exposure limits.
- carcinogens/potential carcinogens.
- safe handling procedures.
- controls.
- emergency and first aid procedures.
- identity of responsible party/date of preparation.
3. In the glossary, find the following terms:
- PEL
 - TLV
 - flash point
 - acute
 - vapor pressure
 - LEL
 - toxic
 - chronic
4. Here, the MSDSs for my work area are kept at _____
-

C. Understanding Labels

1. The purpose of labels is: (check one)

- to provide detailed information about hazardous chemicals
- to give an immediate hazard warning
- to be kept on file in the supervisor's office

2. The 3 key requirements under the HCS are: (check 3)

- must contain graphics
- must show chemical name
- must be in color
- must show a hazard warning
- must show the name/address of the manufacturer, importer or supplier

3. On the label that you are shown, identify the hazard that is indicated by the warning:

D. Understanding Health Information:

1. The higher the dose of a chemical hazard to the body, the (check one) _____ greater _____ lesser is the effect or response.

3. The 3 major routes of entry of a chemical into the body are:

2. Match “acute” and “chronic” effects with the correct description by joining them with lines.

acute	happens after repeated exposures over long period, or the body takes a long time to develop a response
chronic	happens suddenly, normally from a single exposure

3. Match the following words with the correct descriptions by joining them with lines:

toxic/highly toxic	cancer-causing
carcinogen	irritating to skin or eyes; reversible
corrosive	effect to a specific organ or body system
irritant	poisonous/highly poisonous
sensitizer	destroys living tissue; irreversible
target organ effect	causes allergic reactions after repeated exposures

4. The 3 primary types of protective measures used to prevent or minimize chemical exposures are: (check 3)

- ___ personal protective equipment
- ___ engineering controls
- ___ financial
- ___ legal
- ___ work practices
- ___ toxicology
- ___ chemical

Article VI. E. Understanding Flammables and Combustibles:

1. Draw a line to join each name with its correct description:

Flammable	easily ignited, burns rapidly
Combustible	substance capable of fueling a fire

2. Draw lines to join each name with its correct description:

Flammable aerosol	flash point at or above 100 ⁰ F and below 200 ⁰ F
Flammable gas	flash point below 100 ⁰ F
Flammable liquid	yields flame projection of more than 18” at full valve opening
Combustible liquid	any solid that can cause fire by self-ignition
Flammable solid	compressed gas with LEL at/below 13%

3. In this work area, the MSDS for (name a chemical in your work area)

Contains information about: (check each item if you find the information in the MSDS)

_____ physical hazards
_____ health hazards
_____ methods of detection
_____ emergency and handling procedures
_____ First Aid procedures.

F. Understanding Corrosives:

1. Mark the following True (T) or False (F):

_____ Corrosives destroy or damage living tissue irreversibly.

5. Check the signs/symptoms of overexposure to corrosives:

_____ skin - becomes smoother.

_____ skin - burns of the skin.

_____ eyes - burns to the eyes.

_____ eyes - short sightedness.

_____ inhalation (breathing in) - sneezing and coughing.

_____ inhalation (breathing in) - burns to the nose, throat and lungs.

_____ ingestion (swallowing) - bad taste in the mouth.

_____ ingestion (swallowing) - burns to the mouth, throat, stomach.

3. First Aid procedures for injuries from corrosives in this work area are:

4. PPE required for handling corrosives in this work area is:

5. Procedures for corrosive spill/leak cleanup and disposal in this work area are:

G. Understanding Reactive Chemicals:

1. Mark the following statement as True (T) or False (F):

___ Reactive chemicals are likely to cause fire.

2. Check the correct physical properties/hazards and health hazards of reactive chemicals:

___ primarily hazardous as a skin irritant.

___ may be shock, heat or friction sensitive.

___ may be air or water reactive.

___ do not require special extinguishing agents.

___ chemical products from reactivity can be corrosive, poisonous or flammable.

3. In this work area, the MSDS for _____ contains information about: (check each item as you find the information in the MSDS)

___ physical hazards

___ PPE

___ health hazards

___ emergency and handling procedures

___ methods of detection

___ First Aid procedures

H. Understanding Toxic Chemicals:

1. Match the following words with the correct definitions by joining them with lines:

toxic chemicals

cancer-causing chemicals

carcinogens

chemicals that cause adverse health effects

2. Mark the following statement as True (T) or False (F):

___ The higher the dose, the smaller the effect (response).

3. The MSDS will state that a mixture is a health hazard if: [mark True (T) or False (F)]

___ 1% of components are known health hazards.

___ 0.1% of components are known/suspected carcinogens

4. In this work area, the MSDS for _____ contains information about: (check each item if you find the information in the MSDS)

___ physical hazards

___ PPE

___ health hazards

___ emergency and handling procedures

___ methods of detection

___ First Aid procedures