CHEMICAL HANDLING

PROFESSIONAL DEVELOPMENT HOUR CONTINUING EDUCATION COURSE

1.0 CEUs, 10 PDHs, 10 Contact Hours

Technical Learning College

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

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

Technical Learning College's Scope and Function

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

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

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

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

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

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

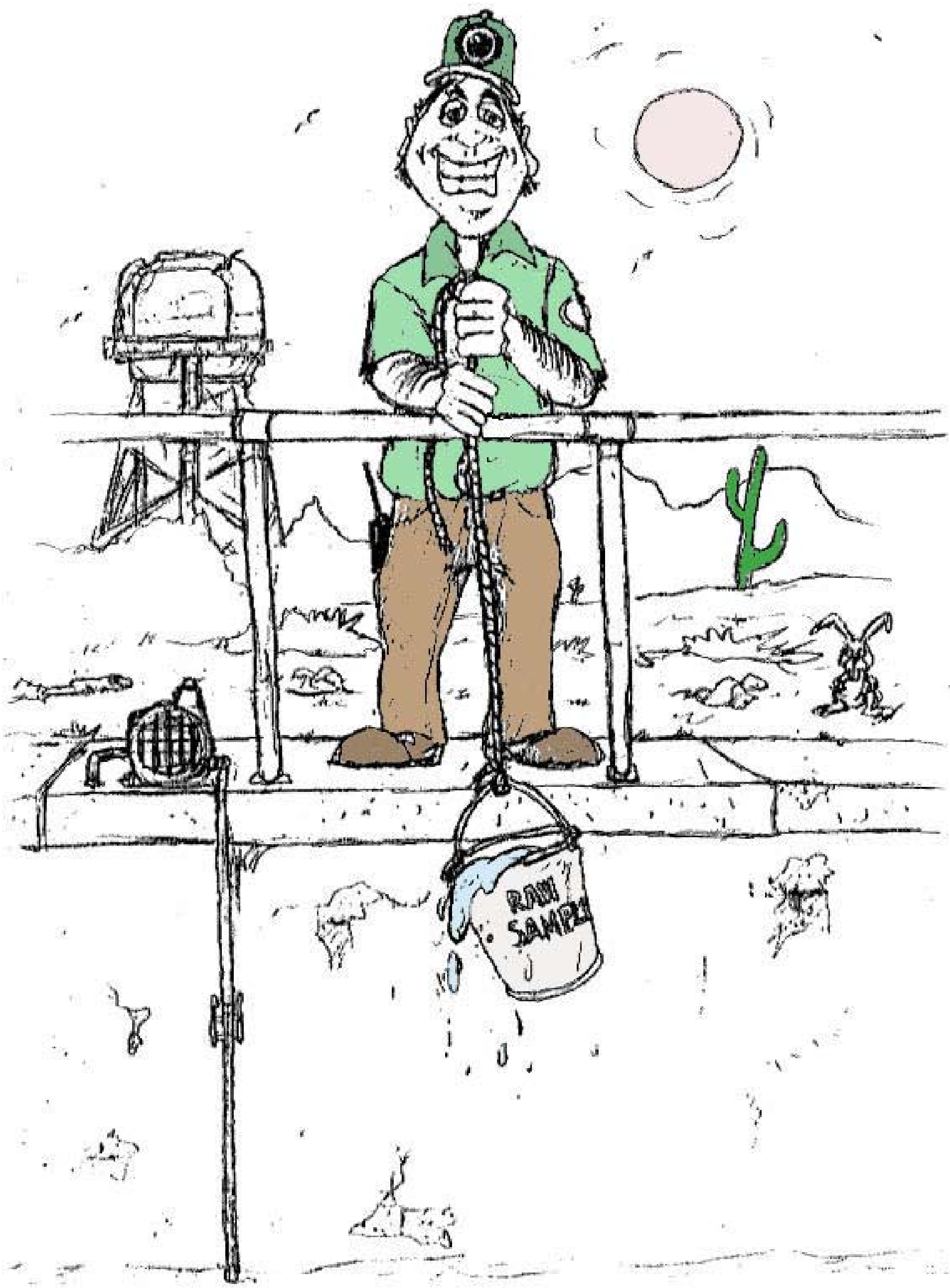
Satisfaction Guaranteed
Our Iron-Clad, Risk-Free Guarantee ensures you will be another satisfied TLC student.

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

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

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

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



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

Course Description

Chemical Handling CEU Training Course

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

Audenice - First Responders, HAZWOPER Refreshers

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

Course Procedures for Registration and Support

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

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

If a student falls behind, he/she must contact TLC and request an end date extension in order to complete the course. It is the prerogative of TLC to decide whether to grant the request. You may be required to pay $40.00. All students will be tracked by their social security number or a unique number will be assigned to the student.

Instructions for Written Assignments

The ***Chemical Handling CEU Training course*** will be a multiple choice style type of an exam. TLC will require that the document is typed and preferably e-mailed to TLC.

Feedback Mechanism (examination procedures)

Each student will receive a feedback form as part of their study packet. You will find this form in the rear of the course or lesson.

Security and Integrity

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

Grading Criteria

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

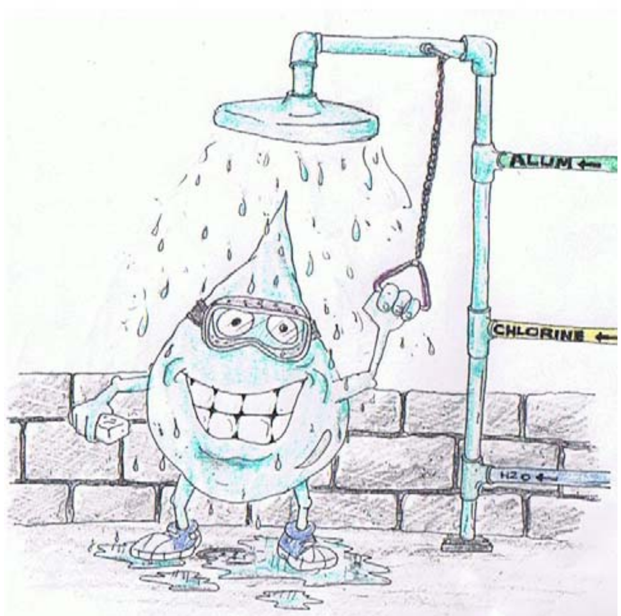
Required Texts

The Chemical Handling CEU Training course does not require any course materials. The course is complete.

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

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

Educational Mission



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

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

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

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

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

Copyright Notice

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

Chemical Handling Introduction

Similar chemicals are used for process control, odor control and sludge conditioning in Water and Wastewater Treatment. Students will learn about the types of chemicals used and how they react in the process. Students will also learn about chemical safety and perform on-site equipment assessment. The table below is a list of **general** chemicals used in Water and Wastewater. They may very by the manufacture; a perfect example would be Thioguard®, which is Magnesium Hydroxide. In this class we will discuss the chemical name and compound and leave out manufacture trade names.

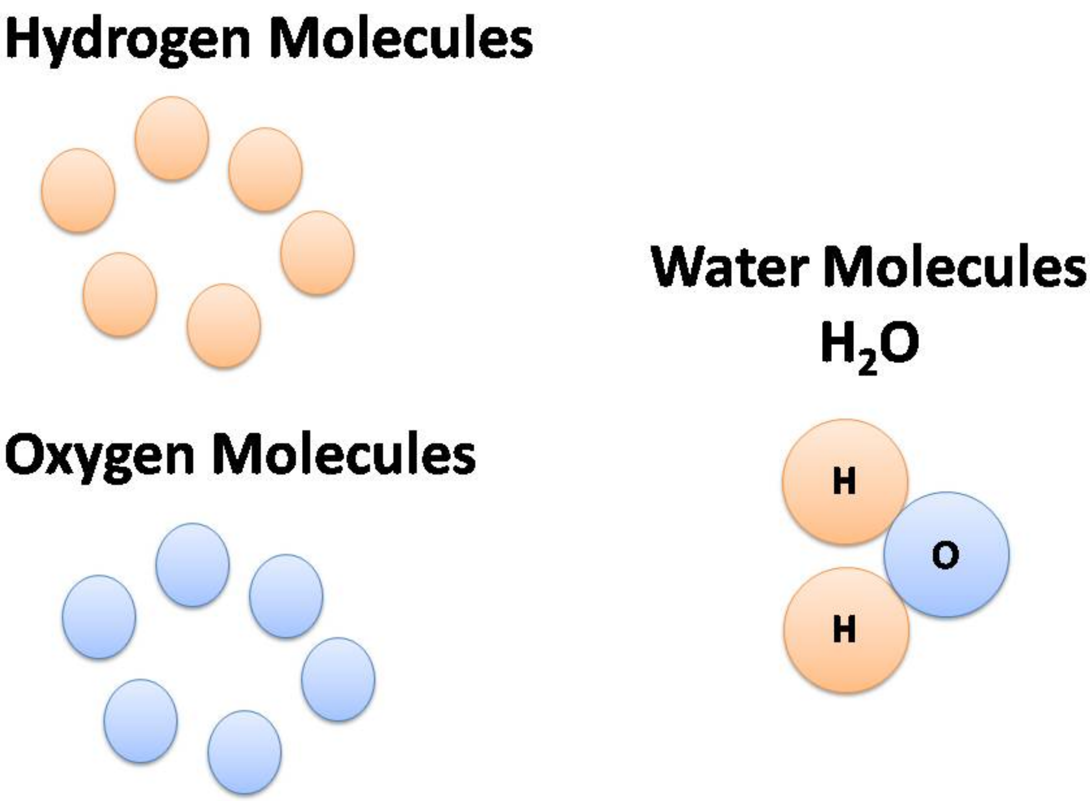
Common Water/Wastewater Treatment Chemicals

Chemical Name	Common Name	Chemical Formula	pH (Raise or Lowers)
Aluminum hydroxide		$Al(OH)_3$	
Aluminum sulfate	Alum, liquid	$AL_2(SO_4)3 . 14(H_2O)$	
Ammonia		NH_3	
Ammonium		NH_4	
Bentonitic clay	Bentonite		
Calcium bicarbonate		$Ca(HCO_3)2$	
Calcium carbonate	Limestone	$CaCO_3$	
Calcium chloride		CaCl2	
Calcium Hypochlorite	HTH	$Ca(OCl)_2 . 4H_2O$	
Calcium hydroxide	Slaked Lime	$Ca(OH)_2$	
Calcium oxide	Unslaked (Quicklime)	CaO	
Calcium sulfate	Gypsum	$CaSO_4$	
Carbon	Activated Carbon	C	
Carbon dioxide		CO_2	
Carbonic acid		$H2CO_3$	
Chlorine gas		Cl2	
Chlorine Dioxide		ClO_2	
Copper sulfate	Blue vitriol	$CuSO_4 . 5H_2O$	
Dichloramine		NHCl2	
Ferric chloride	Iron chloride	$FeCl_3$	
Ferric hydroxide		$Fe(OH)_3$	
Ferric sulfate	Iron sulfate	$Fe_2(SO_4)_3$	
Ferrous bicarbonate		$Fe(HCO_3)_2$	
Ferrous hydroxide		$Fe(OH)_3$	
Ferrous sulfate	Copperas	$FeSO_4.7H_20$	
Hydrofluorsilicic acid		H_2SiF_6	
Hydrochloric acid	Muriatic acid	HCl	
Hydrogen sulfide		H_2S	

Chemical Name	Common Name	Chemical Formula	pH (Raise or Lowers)
Hypochlorus acid		HOCL	
Magnesium bicarbonate		$Mg(HCO_3)2$	
Magnesium carbonate		$MgCO_3$	
Magnesium chloride		MgCl2	
Magnesium hydroxide		$Mg(OH)_2$	
Magnesium dioxide		MgO_2	
Manganous bicarbonate		$Mn(HCO_3)2$	
Manganous sulfate		$MnSO_4$	
Monochloramine		NH_2Cl	
Potassium bicarbonate		$KHCO_3$	
Potassium permanganate		$KMnO_4$	
Sodium carbonate	Soda ash	Na_2CO_3	
Sodium chloride	Salt	NaCl	
Sodium chlorite		$NaClO_2$	
Sodium fluoride		NaF	
Sodium fluorsilicate		Na_2SiF_6	
Sodium hydroxide	Lye	NaOH	
Sodium hypochlorite		NaOCl	
Sodium Metaphosphate	Hexametaphosphate	$NaPO_3$	
Sodium phosphate	Disodium phosphate	Na_3PO_4	
Sodium sulfate		Na_2SO_4	
Sulfuric acid		H_2SO_4	

Solubility of Substances in Water

Water is an excellent solvent for many compounds. Some dissolve in it as molecules while others, called electrolytes, dissociate and dissolve not as neutral molecules but as charged species called ions. Compounds which exist as solid ionic crystals dissolve in water as ions, and most of them are highly soluble in water. “Highly soluble” is a somewhat elastic description, but generally means soluble to at least the extent of forming 0.1 to 1.0 molar aqueous solutions. Salts which are less soluble in water than this at room temperature are called slightly soluble salts.



The solubility of an ionic salt depends both upon its cations and its anions, but for simple salts in aqueous solution at room temperature the following general observations are useful. Almost all sodium, potassium, and ammonium salts are highly soluble; the only significant exception is $KClO_4$, which is moderately soluble almost without exception. Metal carbonates and phosphates are generally insoluble or slightly soluble, with the exception of those of sodium, potassium, and ammonium which are highly soluble; magnesium ammonium phosphate is used for the precipitation of magnesium ion.

Metal halides are generally highly soluble, with the exception of those of silver, lead, and mercury (I). Lead chloride is slightly soluble while silver and mercury (I) chlorides are much less soluble. Sulfate salts are generally highly soluble as well, with more exceptions; calcium, barium, strontium, lead, and mercury (I) sulfates are almost insoluble while silver sulfate is slightly soluble. Metal sulfides are generally insoluble in water.

Solid-Solution (Solubility) Reactions

When solids dissolve, the solutes are no longer pure substances and their activity can no longer be taken as unity. In dilute solutions, aqueous or otherwise, activities of solutes are often taken as equal to their molar concentrations. These equilibria are called solubility equilibria and are taken up under the following main heading. The example below shows how the form in which they are written compares to other equilibrium constants.

Example. The equilibrium constant for the reaction AgCl(s) <--> Ag+(aq)+Cl-(aq) is written as K= a(Ag+)a(Cl-)/a(AgCl); more commonly, it is written in the form Ka(AgCl)=a(Ag+)a(Cl-)=K_{sp}. If the molar concentrations are taken as good approximations to the activities, which in dilute solutions they are, then K_{sp}=[Ag+][Cl].

Example. Let us write and simplify to the extent possible the equilibrium constant for the equilibrium Al^{3+}(aq) + 3OH^-(aq) <--> A1$(OH)_3$(s) For this equilibrium K= 1/[Al^{3+}][OH^-]^3 = 1/K_{sp}. where K has the units dm^{12}/mol^4, or $(dm^3)^4/mol^4$.

The form of equilibrium constant indicated as K_{sp} is called the solubility product constant or, more commonly, the solubility product. This constant therefore must refer to the process of a solid going into solution (solubility) rather than the reverse, precipitation of solid from solution. As a consequence, the ions are products and appear in the numerator.

The value of the solubility product is temperature-dependent and is generally found to increase with increasing temperature. As a consequence, the molar solubility of ionic salts generally increases with increasing temperature. The extent of this increase varies from one salt to another. It is sometimes possible to take advantage of the difference in the effect of temperature to separate mixtures of different soluble salts.
As the chart in the following Figure shows, a solution originally of equal concentration in $KClO_3$ and KNO_3 should upon heating and evaporation of water precipitate $KClO_3$ because KNO_3 is by far the more soluble near the boiling point of water.

The solubility of solid salts in water, and in most other solvents, increases with temperature while that of gases decreases. The heat or enthalpy change of the dissolution reaction for most solids is positive so the dissolution reaction is endothermic. For some solids, such as NaCl, the heat of solution is very small and so the effect of temperature is small also. For other salts, such as KNO_3, the effect of temperature is much larger:

NaCl(c) <--> Na^+(aq) + Cl^-(aq); H0 = (-240.12-167.159) – (-411.153) = +3.87 kJ/mol

KNO_3(c) <--> K^+(aq) + NO_3^-(aq); H0 = (-252.38-205.0)-(-494.63) = +37.3kJ/mol

Chemical coagulation in the water/wastewater treatment is the process of bringing suspended matter in untreated water together for the purpose of settling and for the preparation of the water for filtration.

Coagulation involves three specific steps, which are:

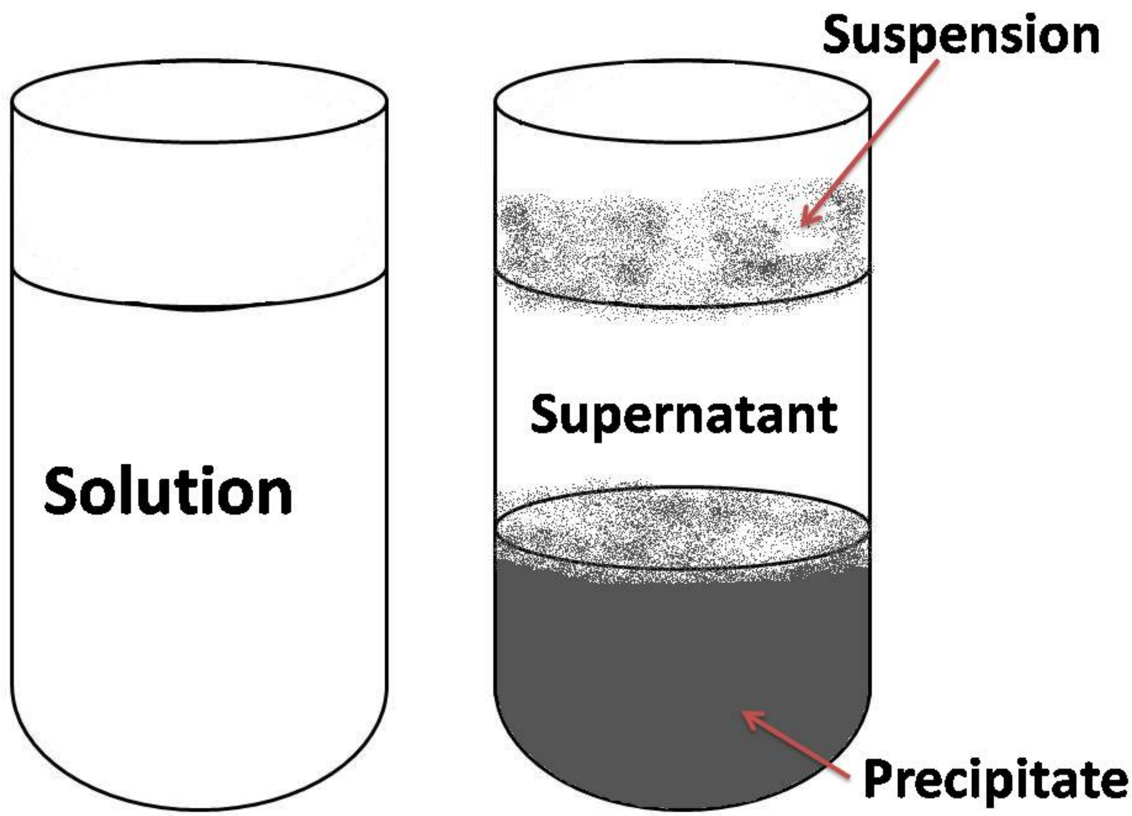
- Coagulation
- Flocculation
- Sedimentation

Purpose of Coagulation

Untreated surface waters contain clay, minerals, bacteria, inert solids, microbiological organisms, oxidized metals, organic color producing particles, and other suspended materials. Some of the microbiological organisms can include Giardia cysts, pathogenic bacteria, and viruses. Oxidized metals include iron and manganese. All of these materials can inhibit disinfection, cause problems in the distribution system, and leave the water cloudy rather than clear.

The purpose of coagulation is to remove these particles. The ability of particles to remain suspended in water is a function of both the particle size and specific gravity. Turbidity particles can range in size from molecular to 50 microns. Particles which are greater than one micron in diameter are considered silt, and settle out due to their relatively large size and density without the need to coagulate in a matter of seconds or minutes.

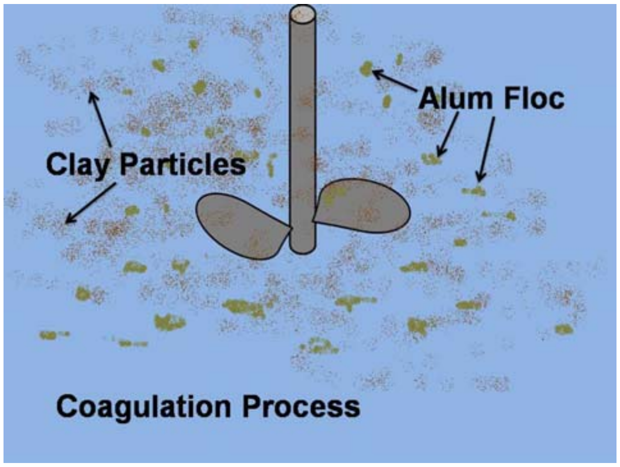
Colloidal material ranges in size from 0.001 to one micron in diameter. These materials require days to months for complete settling. Since detention times in the water treatment process are generally less than twelve hours, the rate of settling of these colloidal particles must be increased in the water treatment process. This is accomplished in the coagulation process when tiny particles agglomerate into larger, denser particles which will settle more quickly as shown below.



These tiny colloidal particles have a very large surface area to mass ratio, and this factor is important in keeping the particles suspended for long periods of time. In fact, the surface area to mass ratio is so high that electric charges and ionic groups become important in keeping the particles suspended. Two types of colloids exist. These are hydrophobic or water hating colloids, and hydrophilic or water loving colloids. Hydrophilic colloids form suspensions easily, and can be difficult to remove. These colloids can, however, react chemically with the coagulants commonly added to water under proper conditions. Examples of hydrophilic colloids would be organic color forming compounds. Hydrophobic colloids do not easily form suspensions. The reactions between hydrophobic colloids and the coagulants commonly added to water are largely physical rather than chemical. Examples of hydrophobic colloids would be clays and metal oxides.

The Coagulation Process

Coagulation is accomplished by the addition of ions having the opposite charge to that of the colloidal particles. Since the colloidal particles are almost always negatively charged, the ions which are added should be cations or positively charged. The coagulating power of an ion is dependent on its valency or magnitude of charge. A bivalent ion (+2 charge) is 30 to 60 times more effective than a monovalent ion (+I charge). A trivalent ion (+3 charge) is 700 to 1000 times more effective than a monovalent ion.



Typically, two major types of coagulants are added to water. These are aluminum salts and iron salts. The most common aluminum salt is aluminum sulfate, or alum. When aluminum sulfate is added to water, the aluminum ions enter into a series of complicated reactions. The aluminum ions become hydrated, meaning that water molecules attach themselves to the aluminum ions. In addition, anions present in the water, such as hydroxide and sulfate ions can attach to the aluminum ions. These reactions result in large, positively charged molecules having aluminum ions at their center. These particles may have charges as high as +4. Following these reactions, a second type of reaction occurs, called Olation. This reaction involves the bridging of two or more of these large molecules to form even larger, positively charged ions. A typical molecule can contain eight aluminum ions, twenty hydroxide ions, and will have a +4 charge. Iron salts behave in a similar manner when added to water.

Once these large polymeric aluminum or iron compounds are formed, the magnitude of their high positive charge allows these species to rapidly move toward the colloid, where they are adsorbed onto the negatively charged surface of the turbidity particle. The coagulant compounds can penetrate the bound water layer because of their high positive charge. This rapid adsorption results in the compression of the electrical double layer, and results in the colloid becoming coated with the coagulant compounds. The net result of this process is that the electrical charges on the particle are reduced. The suspension is now considered to be destabilized, and the particles can be brought together through, among other forces, Brownian Movement, and will be held together by the Van der Waals forces.

An additional process occurs which assists this process. As the coagulant continues to undergo the hydrolyzation and olation reactions, progressively larger masses of flocculent material are formed. These compounds can become large enough to settle on their own, and tend to trap turbidity particles as they settle. This is commonly referred to as sweep floc.

As the coagulation reactions and destabilization are occurring, the Zeta Potential at the surface of the colloid is also found to be reducing. Typically, the Zeta Potential for a naturally occurring water may be in the range of -10 to -25 millivolts. As the reactions occur, this Zeta Potential will be reduced to approximately -5 millivolts. These figures are only examples of what might be considered typical waters. Since all waters exhibit a specific set of characteristics, these numbers will vary. It is interesting to note that the Zeta Potential does not have to be reduced to zero in order for coagulation to occur, because the forces of attraction can become predominant before complete destabilization occurs.

Hydrophilic colloids participate in the coagulation process in a slightly different way. These colloids tend to attract water molecules and attach these water molecules to their surfaces. This is also a hydration process, and the water molecules act as a barrier to contact between particles. Also attached to the surfaces are hydroxyl, carboxyl, and phosphate groups, all to which are negatively charged. Coagulant products react chemically with the negatively charged groups attached to the hydrophilic colloids, forming an insoluble product which is electrically neutral and destabilized.

Factors Influencing Coagulation

Effects of pH: The pH range in which a coagulation process occurs may be the single most important factor in proper coagulation. The vast majority of coagulation problems are related to improper pH levels. Whenever possible, coagulation should be conducted in the optimum pH zone. When this is not done, lower coagulation efficiency results, generally resulting in a waste of chemicals and a lowered water quality. Each of the inorganic salt coagulants has its own characteristic optimum pH range. In many plants, it is necessary to adjust the pH level in the coagulation process. In most cases this involves the addition of lime, caustic soda, or soda ash to maintain a minimum pH level. In some cases, however, acids may be necessary to lower the pH level to an optimum range. In some water plants, the acidic reactions of the inorganic salts are taken advantage of when the raw water pH levels are higher than desired. In these instances, overfeed of the coagulant is intentionally induced in order for the coagulation process to occur in the optimum range.

Effects of salts: Since no natural waters are completely pure, each will have various levels of cations and anions such as calcium, sodium, magnesium, iron, manganese, sulfate, chloride, phosphate, and others. Some of these ions may affect the efficiency of the coagulation process. Generally, mono and divalent cations such as sodium, calcium, and magnesium have little or no effect on the coagulation process. Trivalent cations do not have an adverse effect on the process in most instances. In fact, significant concentrations of naturally occurring iron in a water supply has resulted in the ability to feed lower than normal dosages of inorganic salt coagulants. Some anions can have a more pronounced effect. Generally, monovalent anions such as chloride have little effect on the coagulation process. As the concentration of the divalent anion sulfate in a water supply increases, the optimum pH range of the inorganic salt coagulants tends to broaden, generally toward the lower pH levels. As the concentration of phosphate ions increase, the optimum range of pH tends to shift to lower pH levels, without broadening. These effects could cause a disruption of the coagulation process if abrupt changes in the concentrations of these anions occur in the water supply.

Nature of turbidity: The turbidity in natural surface waters is composed of a large number of sizes of particles. The sizes of particles can be changing constantly, depending on precipitation and manmade factors. When heavy rains occur, runoff into streams, rivers, and reservoirs occurs, causing turbidity levels to increase. In most cases, the particle sizes are relatively large and settle relatively quickly in both the water treatment plant and the source of supply. However, in some instances, fine, colloidal material may be present in the supply, which may cause some difficulty in the coagulation process. Generally, higher turbidity levels require higher coagulant dosages. However, seldom is the relationship between turbidity level and coagulant dosage linear. Usually, the additional coagulant required is relatively small when turbidities are much higher than normal due to higher collision probabilities of the colloids during high turbidities. Conversely, low turbidity waters can be very difficult to coagulate due to the difficulty in inducing collision between the colloids. In this instance, floc formation is poor, and much of the turbidity is carried directly to the filters. Organic colloids may be present in a water supply due to pollution, and these colloids can be difficult to remove in the coagulation process. In this situation, higher coagulant dosages are generally required.

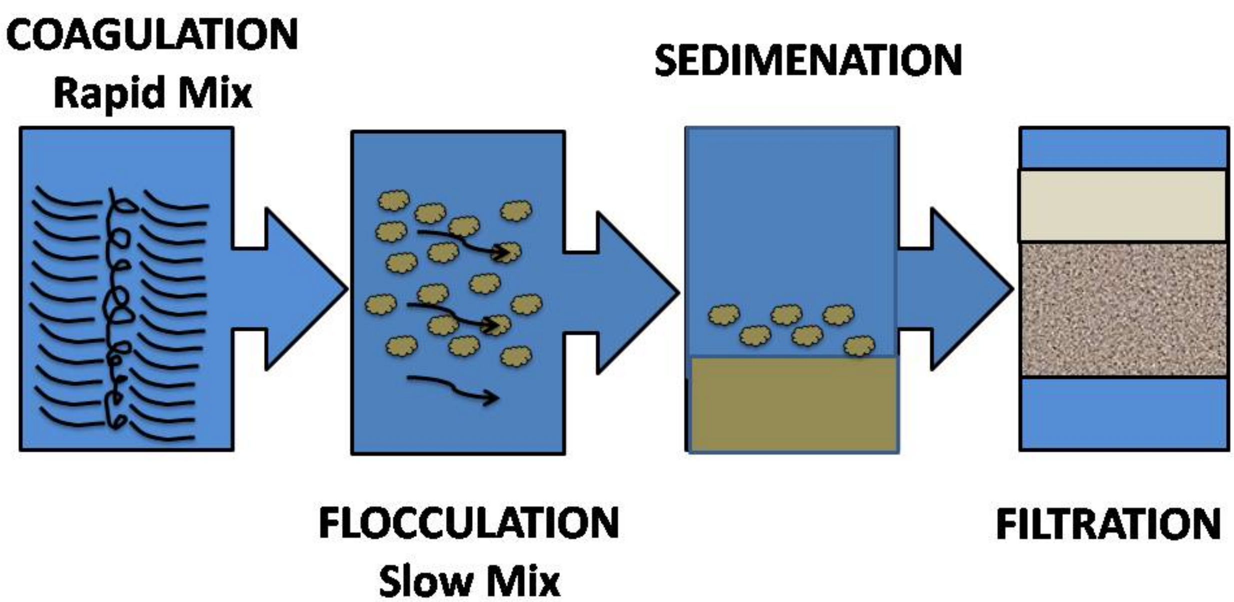
Water temperature: Cold water temperatures can cause two factors which add to the difficulty of the coagulation process. As water temperatures approach freezing, almost all chemical reactions occur more slowly. It can be more difficult therefore to evenly disperse the coagulants into the water. As a result, the coagulant process becomes less efficient, and higher coagulant dosages are generally used to compensate for these effects. In addition, floc settling characteristics become poor due to the higher density of the water during near freezing temperatures.

Mixing Effects: Poor or inadequate mixing results in an uneven dispersion of the coagulant. Unfortunately, many older plants were designed with mixing facilities which generally do not accomplish mixing in the most efficient manner. As a result, it becomes necessary to use higher than necessary dosages of coagulant to achieve an optimum level of efficiency in the process. The effects of low turbidity and cold water temperatures can tend to aggravate the lack of adequate mixing facilities in some plants.

Effect of the coagulant: The choice of the proper coagulant for the given conditions is of critical importance in maintaining an efficient coagulation scheme under widely varying conditions. The chemicals most commonly used in the coagulation process are Aluminum Sulfate, Ferric Chloride, Ferric Sulfate, and Cationic Polymers.

Coagulants

Aluminum Sulfate (Alum): Aluminum Sulfate is also known as alum, filter alum, and alumina sulfate. Alum is the most widely used coagulant. Alum is available in dry form as a powder or in lump form. It can also be purchased and fed as a liquid. Alum has no exact formula due to the varying water molecules of hydration which may be attached to the aluminum sulfate molecule...Once in water, alum can react with hydroxides, carbonates, bicarbonates, and other anions as discussed previously to form large, positively charged molecules...Carbon dioxide and sulfate are generally byproducts of these reactions. During the reactions, alum acts as an acid to reduce the pH and alkalinity of the water supply. It is important that sufficient alkalinity be present in the water supply for the various reactions to occur.



On a theoretical basis, 1.0 mg/l of dry alum will react with:
0.50 mg/l of natural alkalinity as calcium carbonate
0.33 mg/l of 85% quicklime as calcium oxide
0.39 mg/l of 95% hydrated lime as calcium hydroxide
0.54 mg/l of soda ash as sodium carbonate

Alum can be effective in the pH range of 5.5 to 7.8, but seems to work best in most water supplies in a pH range of 6.8 to 7.5. Below a pH range of 5.5, alkalinity in the water supply is generally insufficient.

The aluminum ions become soluble rather than insoluble and do not participate in the hydration and olation reactions necessary to make the alum effective as a coagulant. In these instances the plant may experience higher than normal filtered water turbidities, and much of the aluminum will pass through the filters.

When the pH level of the water is above 7.8 after the addition of the alum, the aluminum ions again become soluble, and the efficiency of coagulation is decreased. Under these conditions, aluminum ions again penetrate the filters, and post filtration alum coagulation can occur in the clear well and in the distribution system in some cases.

Ferric Chloride (Ferric): Traditionally, ferric chloride has not been used widely as a coagulant, but this trend is not continuing. Ferric chloride is becoming more extensively used as a coagulant due partially to the fact that the material can be purchased as a liquid.

Ferric chloride may also be purchased as an anhydrous solid. Liquid ferric chloride is highly corrosive, and must be isolated from all corrodible metals. Like ferric sulfate, ferric chloride exhibits a wide pH range for coagulation, and the ferric ion does not easily become soluble. As a result, many plants are replacing alum with ferric chloride to eliminate the penetration of aluminum ions through the plant filters. Ferric chloride also reacts as an acid in water to reduce alkalinity.

Other inorganic coagulants are available, such as potash alum, ammonia alum, ferrous sulfate (copperas), and chlorinated copperas. None of these materials are widely used. Typical dosages of the inorganic coagulants range from 50 pounds per million gallons of water treated under ideal conditions to as high as 800 to 1000 pounds per million gallons of water treated under worst case conditions.

H_2S Control – Traditional Wet Scrubbing using Chemicals

The most common method of control of H_2S gas is to pass the smelly gas through a vertical, packed bed wet scrubber. The air passes up the tower as the scrubbing liquid containing caustic (NaOH) and oxidizing agent (most often bleach or NaOCl, sodium hypochlorite) flows down the tower in the counter-current fashion. The high pH provided by the caustic drives the mass transfer from gas to liquid phase by solubolizing H_2S as HS^- bisulfide and S^{-2} sulfide ions. Once in solution, the reaction between hydrogen sulfide and oxidizing agent is almost instantaneous (assuming sufficient oxidizing agent is present). This reaction converts the sulfide to sulfate (SO_4^{-2}) ion. The overall chemical reaction is described by the following equation:

$H_2S + 4NaOCl + 2NaOH \rightarrow Na_2SO_4 + 4NaCl + 2H_2O$

Therefore, theoretically, for each molecule of H_2S destroyed, four molecules of bleach and two molecules of caustic are consumed. However, the chemistry is not quite so simple, as partial oxidation of H_2S also takes place which forms elemental sulfur:

$H_2S + NaOCl \rightarrow NaCl + H_2O + S\downarrow$

This reaction represents about 1% of the chemistry present in a wet scrubber. The presence of excess bleach helps to minimize the formation of elemental sulfur. But bleach is an expensive chemical. The use of two stage scrubbing is often employed both to minimize chemical consumption as well as to control sulfur deposits when scrubbing H_2S. The first stage operates at 80% efficiency and uses a caustic only scrub at high pH (12.5). The air then passes to the second stage, where the remaining H_2S is scrubbed with caustic / bleach solution at pH 9.5. The H_2S present is destroyed at 99%+ efficiency. The blowdown from the 2nd stage, which will contain some amount of unsued NaOCl, is sent to the sump of the 1st stage. In this way additional H_2S is destroyed and maximum consumption of expensive oxidizing agent is assured.

Never the less, there are losses of chemicals which can not be prevented, which of course raise the cost of odor scrubbing. These losses are due to the facts that bleach, NaOCl, slowly decomposes in storage as well as the fact that some amount of caustic is constantly lost to CO_2 absorption in both scrubbing stages.

Emissions

Volatile organic compounds (VOCs) are the primary air pollutants emitted from rendering operations. The major constituents that have been qualitatively identified as potential emissions include organic sulfides, disulfides, C-4 to C-7 aldehydes, trimethylamine, C-4 amines, quinoline, dimethyl pyrazine, other pyrazines, and C-3 to C-6 organic acids. In addition, lesser amounts of C-4 to C-7 alcohols, ketones, aliphatic hydrocarbons, and aromatic compounds are potentially emitted. No quantitative emission data were presented.

Historically, the VOCs are considered an odor nuisance in residential areas in close proximity to rendering plants, and emission controls are directed toward odor elimination. The odor detection threshold for many of these compounds is low; some as low as 1 part per billion (ppb). Of the specific constituents listed, only quinoline is classified as a hazardous air pollutant (HAP). In addition to emissions from rendering operations, VOCs may be emitted from the boilers used to generate steam for the operation.

UNSTABLE: Tending toward decomposition or another state, or as produced or transported, will vigorously polymerize, decompose, condense, or become self-reactive under condition of shocks, pressure, or temperature.

Hazard Communication Introduction
Revised Hazard Communication Program

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

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

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

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

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

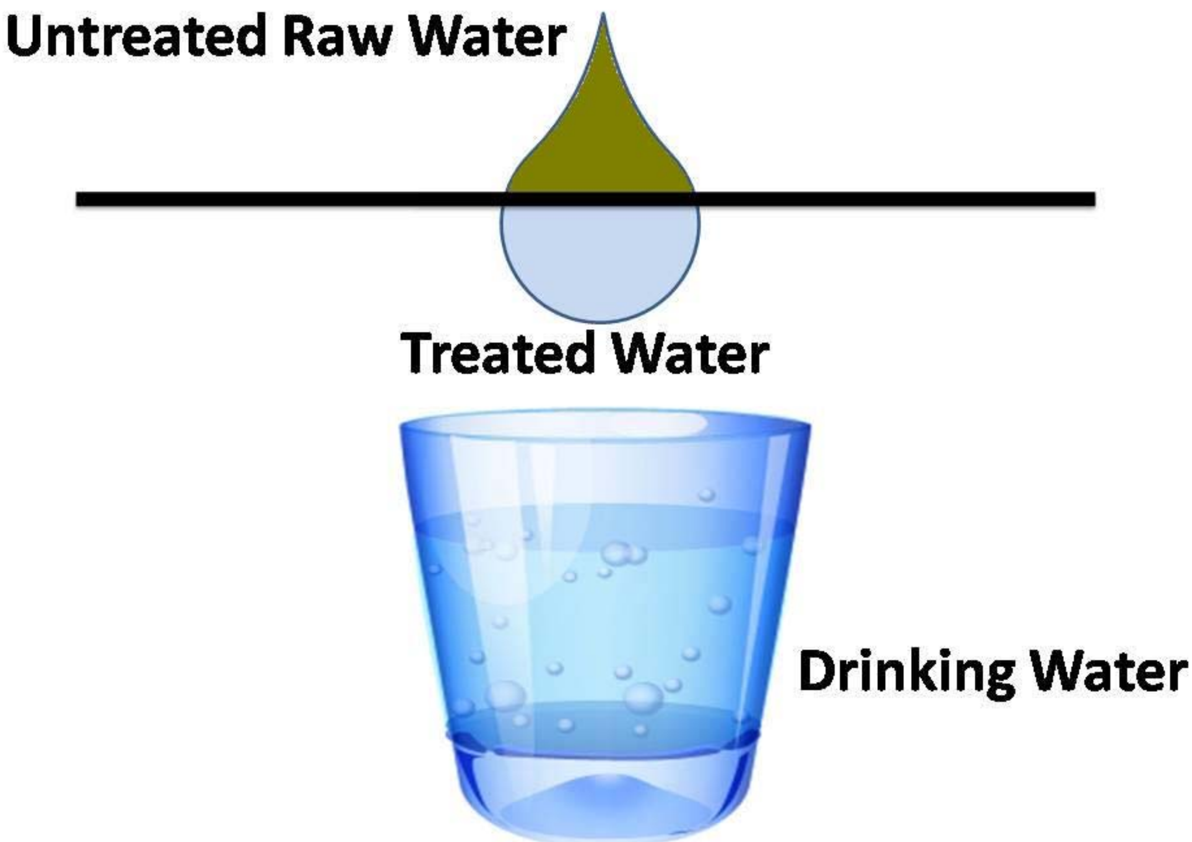
As the global market has expanded to include many countries and languages so has the labeling of hazards of chemical products. Several years ago the United Nations recognized this as a problem and began a push for countries to adopt a standardized system of classification and labeling. As a result, in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

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

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

GHS Concept	How it affects the employer	The challenge
Material Safety Data Sheets	MSDSs will become Safety Data Sheets (SDS). The new SDS will be in a standardized format and provide additional information including ecological information, disposal considerations, transport information and regulatory information. The consistent format will help employees in quickly finding information on the SDS.	Ensuring that all MSDSs are updated to the new SDS format and making sure this information is distributed accurately to employees will be difficult. One of the key challenges will be working with your chemical product vendors to produce the SDSs in a timely manner.
Container Labeling	The GHS standard will become a requirement and replace HMIS, NFPA or any other labeling system you are currently using. The new format includes pictograms, signal words and physical, health and environmental hazard statements. The labels must also have precautionary measures, pictograms and first aid statements along with complete chemical identification and manufacturer contact information.	Properly labeling all secondary and tertiary containers is a significant task. The employer must ensure all containers are labeled properly. This includes original containers received from vendors. Unfortunately, you cannot assume that your vendors will be able to provide the labeling information in a timely fashion. Additionally, it is unlikely OSHA will require chemical manufacturers to produce SDSs for discontinued products so employers will be stuck determining GHS labels for older products.

Training	Employees will need educated on the label and MSDS changes due to the updated product classifications, pictograms, signal words and precautionary statements. Written programs will need updated to include changes to labeling, MSDS communication and employee training.	OSHA has stated that employers will be required to train employees within 2 years of the publication of the final rule. Training employees and updating the written program will require significant resources and should occur as soon as your organization begins its GHS transition.



Most water treatment plants use bulk containment for chemicals storage. The plants are required to have containment walls to hold any spilled chemicals from the tanks.

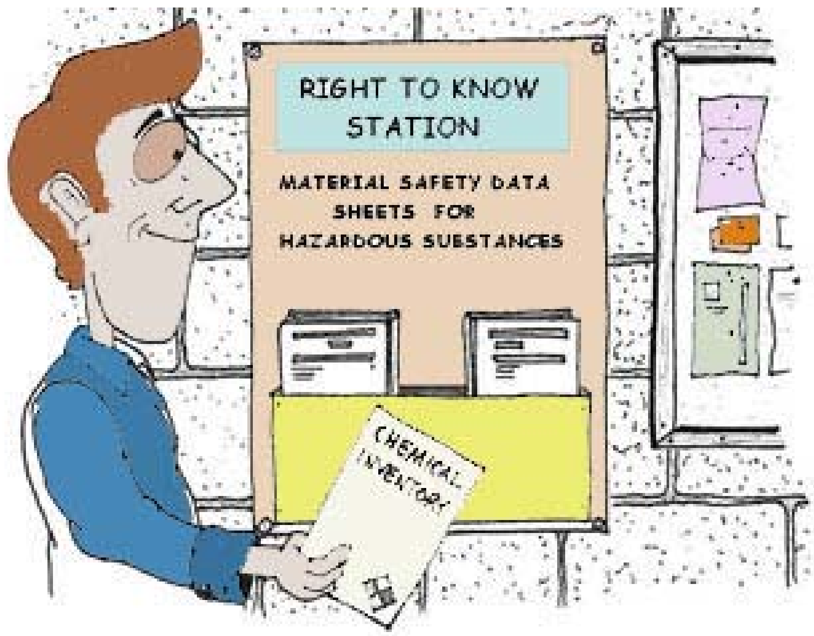
These photographs above show containers that holds a mixture of rain water and chemicals. Not all chemicals are allowed to be discharged into the sewers so they have to be sent out as a hazardous waste.

This photograph shows a delivery of Sulfuric Acid. The delivery driver is wearing only work gloves. He is clearly in violation of the proper PPE. Before starting jobs involving possible exposure to hazardous substances, employees must read SDS (formerly MSDS) s to know what they're working with and procedures for safe handling.

More on the Revised Hazard Communication Standard

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

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



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

- Chemical manufacturers and importers are required to evaluate the hazards of the chemicals they produce or import, and prepare labels and safety data sheets to convey the hazard information to their downstream customers;
- All employers with hazardous chemicals in their workplaces must have labels and safety data sheets for their exposed workers, and train them to handle the chemicals appropriately.

Major changes to the Hazard Communication Standard
Hazard classification: Provides specific criteria for classification of health and physical hazards, as well as classification of mixtures.

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

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

Information and training: Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding.

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

What is the Globally Harmonized System?

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

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

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

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

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

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

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

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

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

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

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

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

Hazard classification: The definitions of hazard have been changed to provide specific criteria for classification of health and physical hazards, as well as classification of mixtures. These specific criteria will help to ensure that evaluations of hazardous effects are consistent across manufacturers, and that labels and safety data sheets are more accurate as a result.

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

Safety Data Sheets: Will now have a specified 16-section format.
The GHS does not include harmonized training provisions, but recognizes that training is essential to an effective hazard communication approach. The revised Hazard Communication Standard (HCS) requires that workers be re- trained within two years of the publication of the final rule to facilitate recognition and understanding of the new labels and safety data sheets.

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

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

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

The hazard classification approach in the revised HCS is quite different. The revised HCS has specific criteria for each health and physical hazard, along with detailed instructions for hazard evaluation and determinations as to whether mixtures or substances are covered. It also establishes both hazard classes and hazard categories—for most of the effects; the classes are divided into categories that reflect the relative severity of the effect.

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

1.0 Background

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

1.1 What is the GHS?

The GHS is an acronym for The Globally Harmonized System of Classification and Labeling of Chemicals. The GHS is a system for standardizing and harmonizing the classification and labeling of chemicals. It is a logical and comprehensive approach to:
Defining health, physical and environmental hazards of chemicals;
Creating classification processes that use available data on chemicals for comparison with the defined hazard criteria; and Communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

Figure 1.1
GHS Document ("Purple Book")

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

For example, in the United States (U.S.) there are requirements for classification and labeling of chemicals for the Consumer Product Safety Commission, the Department of Transportation, the Environmental Protection Agency, and the Occupational Safety and Health Administration.
The GHS itself is not a regulation or a standard. The GHS Document (referred to as "The Purple

Book", shown in Figure 1.1) establishes agreed hazard classification and communication provisions with explanatory information on how to apply the system. The elements in the GHS supply a mechanism to meet the basic requirement of any hazard communication system, which is to decide if the chemical product produced and/or supplied is hazardous and to prepare a label and/or Safety Data Sheet as appropriate. Regulatory authorities in countries adopting the GHS will thus take the agreed criteria and provisions, and implement them through their own regulatory process and procedures rather than simply incorporating the text of the GHS into their national requirements.

The GHS Document thus provides countries with the regulatory building blocks to develop or modify existing national programs that address classification of hazards and transmittal of information about those hazards and associated protective measures. This helps to ensure the safe use of chemicals as they move through the product life cycle from "cradle to grave."

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

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

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

<table>
<tr><td colspan="9">Acute oral toxicity LD50 (mg/kg)</td></tr>
<tr><td rowspan="2">Organization/Country/
Regulation or
Standard</td><td colspan="2">High</td><td colspan="4">Hazard</td><td colspan="2">Low</td></tr>
<tr><td colspan="2">0 ....</td><td colspan="2">< 50 ....</td><td colspan="2">< 500 ....</td><td colspan="2">< 5000
............</td></tr>
<tr><td>ANSI/US/A 129.1</td><td colspan="2">< 50
Highly Toxic</td><td colspan="2">> 50 < 500
Toxic</td><td>> 500 <
2000
Harmful</td><td colspan="3"></td></tr>
<tr><td>OSHA/US/HCS</td><td colspan="2">< 50
Highly Toxic</td><td colspan="2">> 50 < 500
Toxic</td><td colspan="4"></td></tr>
<tr><td>EPA/US/FIFRA</td><td colspan="2">0 ≤ 50
Toxicity Category I</td><td colspan="2">> 50 ≤ 500
Toxicity
Category II</td><td colspan="2">> 500 < 5000
Toxic Category III</td><td colspan="2">> 5000
Toxicity
Category
IV</td></tr>
<tr><td>CPSC/US/FHSA</td><td colspan="2">< 50
Highly Toxic</td><td colspan="2">> 50 ≤ 500
Toxic</td><td colspan="4"></td></tr>
<tr><td>GHS</td><td>≤ 5</td><td>> 5 ≤ 50</td><td colspan="2">> 50 ≤ 300</td><td>> 300 ≤ 2000</td><td colspan="3">> 2000 ≤ 5000</td></tr>
<tr><td>DOT/US</td><td>< 5
Picking
Group 1</td><td>> 5 < 50
Picking
Group II</td><td colspan="2">> 50 < 200
(solid)
> 50 > 500
(liquid)
Picking Group III</td><td colspan="4"></td></tr>
<tr><td>NFPA/US</td><td>≤ 5
Hazard
Category
4</td><td>> 5 ≤ 50
Hazard
Category
3</td><td colspan="2">> 50 ≤ 500
Hazard
Category
2</td><td>> 500 ≤ 2000
Hazard
Category
1</td><td colspan="2">> 2000
Hazard
Category
0</td><td></td></tr>
<tr><td>NPCA/US/HMIS</td><td>≤ 1
Toxicity
Rating 4</td><td>> 1 ≤ 50
Toxicity
Rating 3</td><td colspan="2">> 50 ≤ 500
Toxicity
Rating 2</td><td colspan="2">> 500 ≤ 5000
Toxicity
Rating 1</td><td colspan="2">> 5000
Toxicity
Rating 0</td></tr>
<tr><td>EU</td><td>< 25
Very
Toxic</td><td colspan="2">> 25 > 200
Toxic</td><td colspan="2">> 200 < 2000
Harmful</td><td colspan="3"></td></tr>
<tr><td>WHMIS/Canada</td><td colspan="2">≤ 50
Very Toxic
WHMIS Class D,
Division 1,
Subdivision A</td><td colspan="2">> 50 ≤ 500
Toxic
WHMIS Class D,
Division 1,
Subdivision B</td><td colspan="4"></td></tr>
<tr><td>Australia/NOHSC</td><td>< 25
Very
Toxic</td><td colspan="2">> 25 < 200
Toxic</td><td colspan="2">> 200 < 2000
Harmful</td><td colspan="3"></td></tr>
<tr><td>Mexico</td><td><1
Extremely
Toxic</td><td>>20 < 50
Highly
Toxic</td><td colspan="2">> 50 < 500
Moderately
Toxic</td><td colspan="4">> 500 < 5000
Mildly Toxic</td></tr>
<tr><td>Malaysia</td><td colspan="2">< 25
Very Toxic</td><td colspan="2">200 to 500
Harmful</td><td colspan="4"></td></tr>
</table>

Japan	< 30 Poisonous		300 to 3000 Powerful	
Korea	< 25 Very Toxic	> 50 < 200 Toxic	> 200 < 2000 Harmful	

Figure 1.2
The numerical values on the hazard index scale in the table are not to scale.

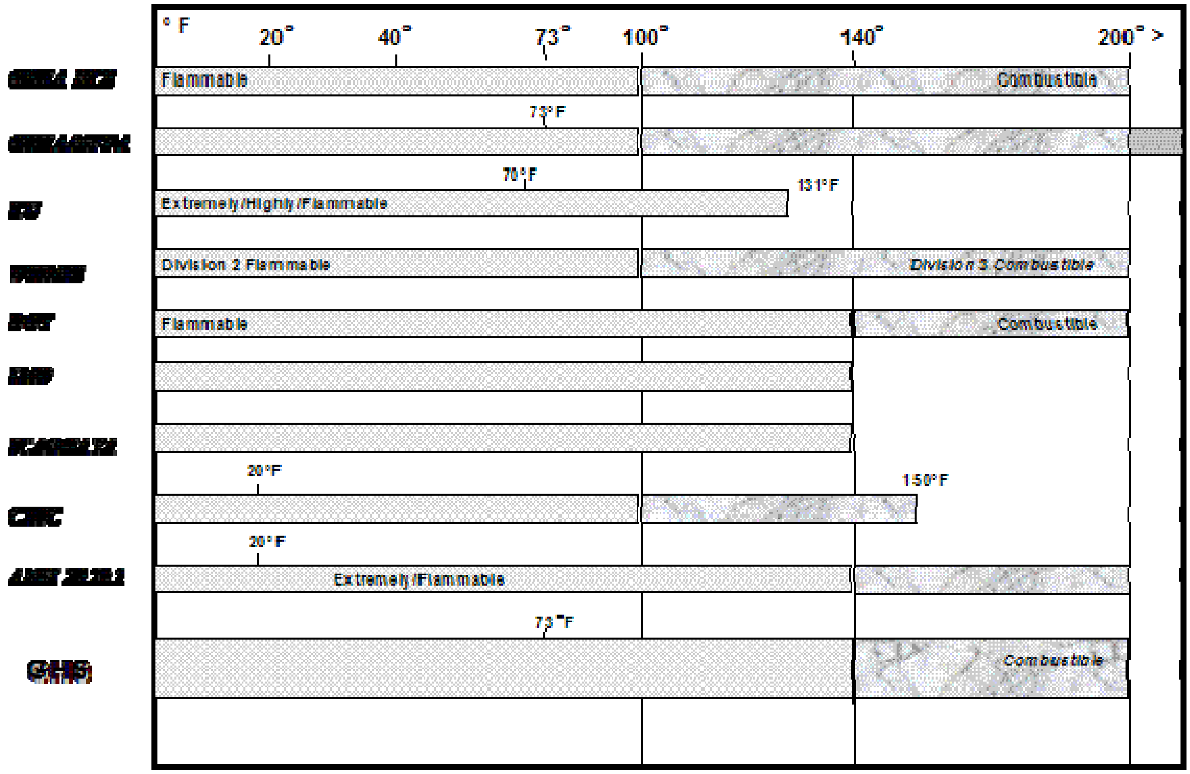
For example, a product may be considered flammable or toxic by one agency or country, but not by another.

We can see by comparing a few hazards how complex it is to comply with all domestic and global regulations. Acute oral toxicity (LD50) is a good example (Figure 1.2). Although most existing systems cover acute toxicity, we can see in the figure that what is considered hazardous varies considerably. These differences allow the same product to be hazardous in one country/system and not in another. At the very least, the same product has different labels and SDSs.

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

Figure 1.3

FLAMMABILITY



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

Text Version of Chart:

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

Chart data:
OSHA HCS
Flammable = 0-100 Degrees
Combustible = 100-200 degrees
OSHA/NFPA
Flammable = 0-100 Degrees
Combustible = 100-200+ degrees
EU
Extremely/Highly/Flammable = 0-131 Degrees
WHMIS
Division 2 Flammable = 0-100 Degrees
Division 3 Combustible = 100-200 degrees
DOT
Flammable = 0-140 Degrees
Combustible = 140-200 degrees
IMO

Flammable = 0-140 Degrees
ICAO/IATA
Flammable = 0-140 Degrees
CPSC
Flammable = 0-100 Degrees
Combustible = 100-150 degrees
ANSI Z129.1
Extremely Flammable = 0-140 Degrees
Combustible = 140-200 degrees
GHS
Flammable = 0-140 Degrees
Combustible = 140-200 degrees

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

These differences in hazards and SDS/labels impact both protection and trade. In the area of protection, users may see different label warnings or safety data sheet information for the same chemical. In the area of trade, the need to comply with multiple regulations regarding hazard classification and labeling is costly and time-consuming. Some multinational companies have estimated that there are over 100 diverse hazard communication regulations for their products globally. For small and medium size enterprises (SMEs) regulatory compliance is complex and costly, and it can act as a barrier to international trade in chemicals.

1.3 What was the International Mandate?

Figure 1.4

International mandate from UNCED Agenda 21, Chapter 19

"A globally harmonized hazard classification and compatible labeling system, including material safety data sheets and easily understandable symbols, should be available, if feasible, by the year 2000."

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

1.4 How was the GHS developed?

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

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

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

Figure 1.5
Existing Systems Included in the Harmonization Process

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

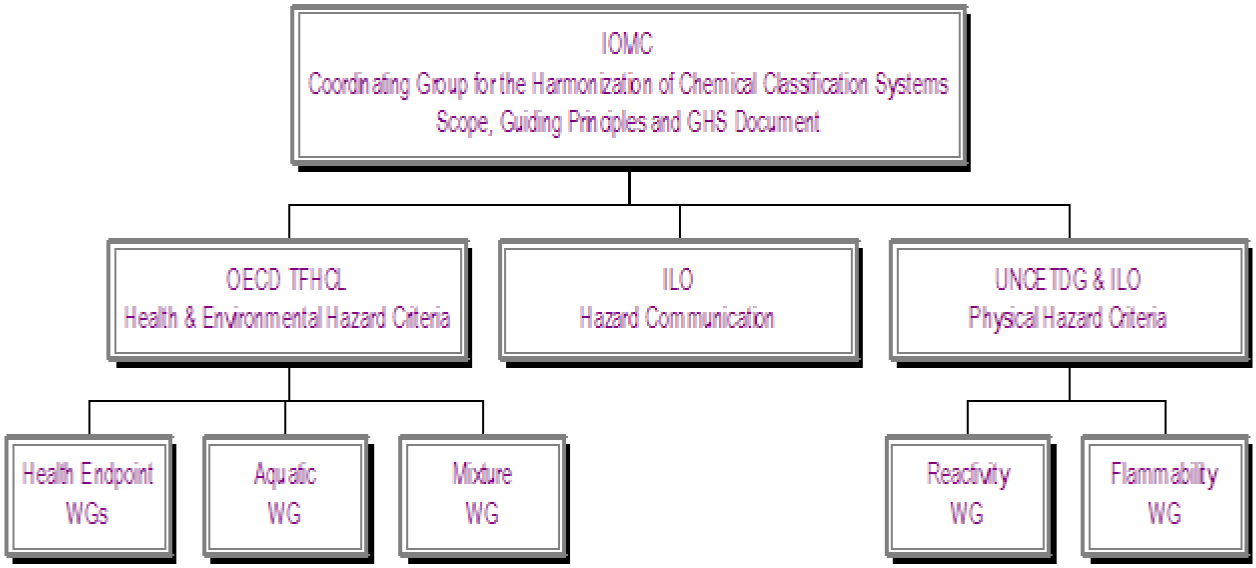
A Coordinating Group for the Harmonization of Chemical Classification Systems (CG/HCCS) was created under the Inter-organization Program for the Sound Management of Chemicals (IOMC) and they were charged with coordinating and managing development of the system. The GC/HCCS worked on a consensus basis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

Figure 1.6
Key Guiding Principles of the Harmonization Process

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

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

Figure 1.7



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

OECD TFHCL Health & Environmental Hazard Criteria	ILO Hazard Communication	UNCE TDG & ILO Physical Hazard Criteria

Health Endpoint WGs	Aquatic WGs	Mixture WGs	Reactivity WGs	Flammability WGs

1.5 How will the GHS be maintained and updated?

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

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

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

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

1.6 When will the GHS be implemented?

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

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

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

1.7 What are the benefits?

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

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

It is anticipated that application of the GHS will:

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

The tangible benefits to governments are:

- ✓ Fewer chemical accidents and incidents,
- ✓ Lower health care costs,
- ✓ Improved protection of workers and the public from chemical hazards,
- ✓ Avoiding duplication of effort in creating national systems,
- ✓ Reduction in the costs of enforcement,
- ✓ Improved reputation on chemical issues, both domestically and internationally.

Benefits to companies include:

- ✓ A safer work environment and improved relations with employees,
- ✓ An increase in efficiency and reduced costs from compliance with hazard communication regulations,
- ✓ Application of expert systems resulting in maximizing expert resources and minimizing labor and costs,
- ✓ Facilitation of electronic transmission systems with international scope,
- ✓ Expanded use of training programs on health and safety,
- ✓ Reduced costs due to fewer accidents and illnesses,
- ✓ Improved corporate image and credibility.

Benefits to workers and members of the public include:

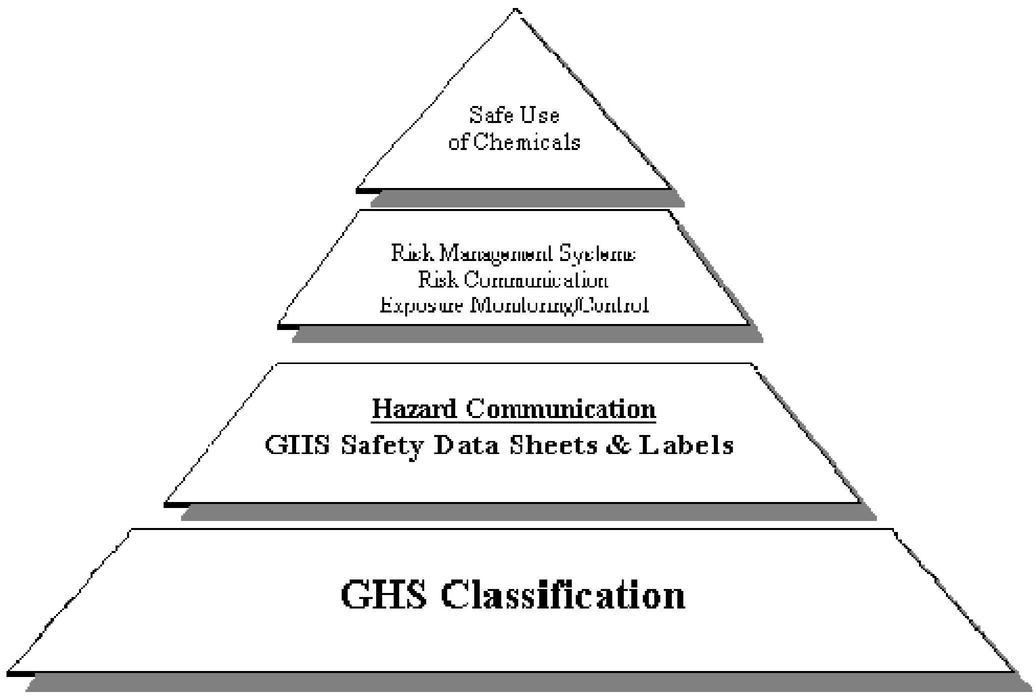
- ✓ Improved safety for workers and others through consistent and simplified communications on chemical hazards and practices to follow for safe handling and use,
- ✓ Greater awareness of hazards, resulting in safer use of chemicals in the workplace and in the home.

2.0 How is the GHS to be applied?

The GHS Classification and Communication elements are the foundation of programs to ensure the safe use of chemicals, as shown in Figure 2.1. The first two steps in any program to ensure the safe use of chemicals are to identify intrinsic hazard(s) (i.e., classification) and then to communicate that information. The design of the GHS communication elements reflect the different needs of various target audiences, such as workers and consumers.

To proceed further up the pyramid, some existing national programs also include risk management systems as part of an overall program on the sound management of chemicals. The general goal of these systems is to minimize exposure, resulting in reduced risk. The systems vary in focus and include activities such as establishing exposure limits, recommending exposure monitoring methods and creating engineering controls. However, the target audiences of such systems are generally limited to workplace settings. With or without formal risk management systems, the GHS is designed to promote the safe use of chemicals.

Figure 2.1



2.1 Are all chemicals covered by the GHS?

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

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

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

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

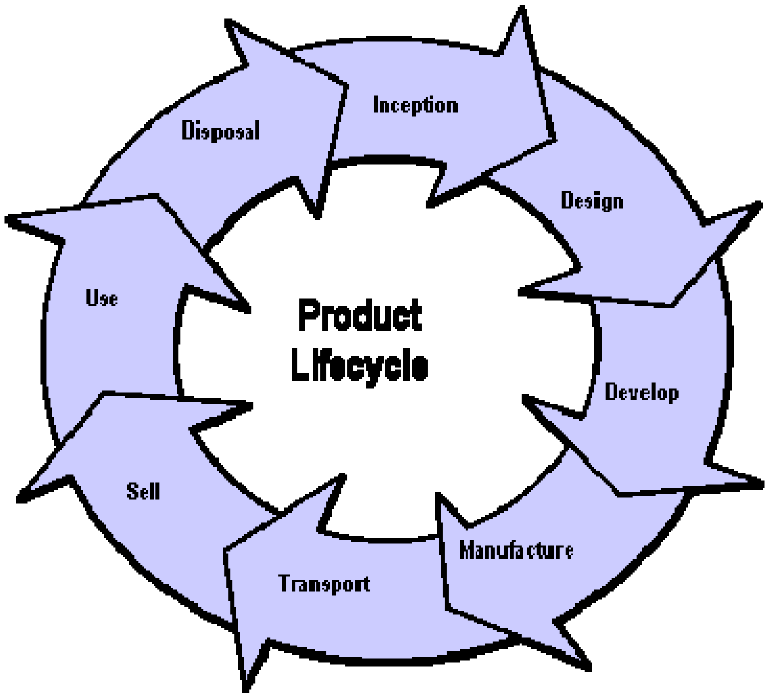


Figure 2.2

The need for GHS labels and/or Safety Data Sheets is expected to vary by product category or stage in the chemical's lifecycle from research/production to end use. The sequence of lifecycle events is shown in Figure 2.2. For example, pharmaceuticals, food additives, cosmetics and pesticide residues in food will not be covered by the GHS at the point of consumption, but will be covered where workers may be exposed (workplaces), and in transport. Also, the medical use of human or veterinary pharmaceuticals is generally addressed in package inserts and is not part of existing hazard communication systems. Similarly, foods are generally not labeled under existing hazard communication systems. The exact requirements for labels and Safety Data Sheets will continue to be defined in national regulations. However, national requirements are expected to be consistent with the detailed discussion of scope provided in Chapter 1.1 of the GHS document.

2.3 How will the GHS impact existing regulations?

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

However, the specific hazard criteria, classification processes, label elements and SDS requirements within an existing regulation will need to be modified to be consistent with the harmonized elements of the GHS. It is anticipated that ALL existing hazard communication systems will need to be changed in order to apply the GHS. For example, in the U.S. EPA and OSHA would be expected to require hazard pictograms/symbols on labels. Canada and the EU would be expected to adopt the GHS pictograms/symbols instead of those currently in use. The transport sector is expected to adopt the changed criteria (LD50/LC50) for the GHS Acute Toxicity Categories 1 - 3. OSHA HCS, WHMIS and the EU would all need to change their acute toxicity criteria.

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

2.4 What is meant by GHS Building Blocks?

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

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

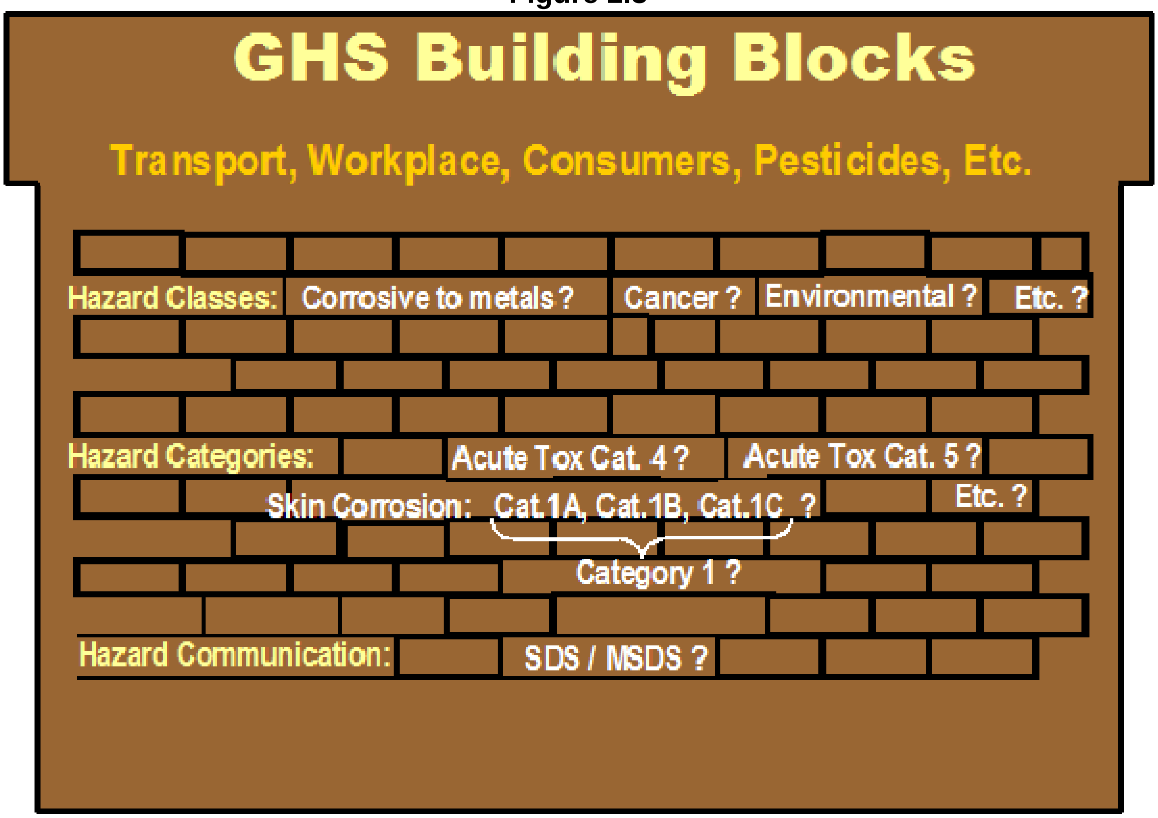
- ✓ Not using a GHS class (e.g., cancer, hazardous to the aquatic environment, etc.);
- ✓ Not using a GHS category (normally at the beginning or end of a class, e.g., Acute Toxicity Cat. 5);
- ✓ Combining categories (e.g., Acute Toxicity Cat.# 1 and Cat.# 2; Skin Corrosion Cat.1A, 1B and 1C).

2.5 How should the GHS Building Blocks by applied?

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

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

Figure 2.3



To gain a better understanding of the building block approach, it is helpful to look at the specific sectors/target audiences. The needs and regulations of the various sectors vary depending on the type of chemical and use pattern. Different target audiences or sectors receive and use hazard information in different ways.

The primary sectors/target audiences are transport, workplace, consumers and agriculture (pesticides). These sectors are described in more detail below.

2.5.1 Transport

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

2.5.2 Workplace

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

- ✓ GHS physical and health hazard criteria, as appropriate;
- ✓ Labels that have the harmonized core information under the GHS (signal words, hazard statements and symbols, etc.);
- ✓ Safety Data Sheets;
- ✓ Employee training to help ensure effective communication is also anticipated;
- ✓ All workplace systems may not have the jurisdiction to adopt environmental hazards.

2.5.3 Consumer

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

2.5.4 Pesticides

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

The appropriate GHS hazard criteria are expected to be adopted;

- Pesticide labels will include the core elements of the GHS (signal words, hazard statements and symbols, etc.), subject to some sector-specific considerations in certain systems.

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

For example:
What is the appropriate legal framework for adopting/implementing the GHS?

What government agencies should be involved? Are there ministries/agencies ready to implement and maintain the GHS?

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

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

Figure 3.1
Hazard Classification

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

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

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

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

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

3.1 What are the GHS Physical Hazards?

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

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

In developing GHS criteria for physical hazards it was necessary to define physical states. In the GHS, a gas is a substance or mixture which at 50°C has a vapor pressure greater than 300 kPa; or is completely gaseous at 20°C and a standard pressure of 101.3 kPa. a liquid is a substance or mixture that is not a gas and which has a melting point or initial melting point of 20°C or less at standard pressure of 101.3 kPa. a solid is a substance or mixture that does not meet the definitions of a liquid or a gas.

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

Figure 3.2
Physical Hazard
Explosives
Flammable Gases
Flammable Aerosols
Oxidizing Gases
Gases Under Pressure
Flammable Liquids
Flammable Solids
Self-Reactive Substances
Pyrophoric Liquids
Pyrophoric Solids
Self-Heating Substances
Substances which, in contact
with water emit flammable gases
Oxidizing Liquids
Oxidizing Solids
Organic Peroxides
Corrosive to Metals

3.1.1 Explosives

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

Classification as an explosive and allocation to a division is a three-step process:
Ascertain if the material has explosive effects (Test Series 1);
Acceptance procedure (Test Series 2 to 4);
Assignment to one of six hazard divisions (Test Series 5 to 7).

Table 3.1 Explosives

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

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

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

3.1.2 Flammable Gases

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

3.1.3 Flammable Aerosols

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

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

Classification is based on:

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

Aerosols are considered:
Nonflammable, if the concentration of the flammable components < 1% and the heat of combustion is < 20 kJ/g.

Extremely flammable, if the concentration of the flammable components >85% and the heat of combustion is > 30 kJ/g to avoid excessive testing.
See the UN Manual of Tests and Criteria for the test method.

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

3.1.5 Gases under Pressure

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

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

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

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

Table 3.2 Gases under Pressure

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

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

3.1.6 Flammable Liquids

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

Table 3.3 Flammable Liquids

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

3.1.7 Flammable Solids

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

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

Table 3.4 Flammable Solids

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

3.1.8 Self-Reactive Substances

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

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

Table 3.5 Self-Reactive Substances

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

Pyrophorics

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

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

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

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

Table 3.6 Substances which on Contact with Water Emit Flammable Gases

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

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

3.1.14 Oxidizing Solids

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

3.1.15 Organic Peroxides

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

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

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

Table 3.7 Organic Peroxides

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

3.1.16 Substances Corrosive to Metal

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

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

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

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

Health and environmental criteria were established for substances and mixtures.
Figure 3.3
Health Hazard
Acute Toxicity
Skin Corrosion/Irritation
Serious Eye Damage/Eye Irritation
Respiratory or Skin Sensitization
Germ Cell Mutagenicity
Carcinogenicity
Reproductive Toxicology
Target Organ Systemic Toxicity - Single Exposure
Target Organ Systemic Toxicity - Repeated Exposure
Aspiration Toxicity
Environmental Hazard
Hazardous to the Aquatic Environment
Acute aquatic toxicity
Chronic aquatic toxicity
Bioaccumulation potential
Rapid degradability
The GHS Health and Environmental Endpoints
The following paragraphs briefly describe the GHS health and environmental endpoints. The criteria for classifying substances are presented first. Then the GHS approach to classifying mixtures is briefly discussed. It is recommended that the person responsible for GHS implementation consult the GHS Document or "Purple Book" for more complete information.

3.2.1 Acute Toxicity

Five GHS categories have been included in the GHS Acute Toxicity scheme from which the appropriate elements relevant to transport, consumer, worker and environment protection can be selected. Substances are assigned to one of the five toxicity categories on the basis of LD50 (oral, dermal) or LC50 (inhalation). The LC50 values are based on 4-hour tests in animals. The GHS provides guidance on converting 1-hour inhalation test results to a 4-hour equivalent. The five categories are shown in the Table 3.8 Acute Toxicity.

Table 3.8 Acute Toxicity

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

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

3.2.2 Skin Corrosion

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

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

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

Table 3.9 Skin Corrosion/Irritation

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

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

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

3.2.3 Skin Irritation

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

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

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

3.2.4 Eye Effects

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

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

Table 3.10 Eye Effects

<table>
<tr><td>Category 1
Serious eye damage</td><td colspan="2">Category 2
Eye Irritation</td></tr>
<tr><td rowspan="2">Irreversible damage 21 days after exposure

Draize score:
Corneal opacity ≥ 3
Iritis > 1.5</td><td colspan="2">Reversible adverse effects on cornea, iris, conjunctiva

Draize score:
Corneal opacity ≥ 1
Iritis > 1
Redness ≥ 2
Chemosis ≥ 2</td></tr>
<tr><td>Irritant
Subcategory 2A
Reversible in 21 days</td><td>Mild Irritant
Subcategory 2B
Reversible in 7 days</td></tr>
</table>

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

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

3.2.5 Sensitization

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

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

3.2.6 Germ Cell Mutagenicity

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

Table 3.11 Germ Cell Mutagenicity

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

3.2.7 Carcinogenicity

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

Table 3.12 Carcinogenicity

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

3.2.8 Reproductive Toxicity

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

Table 3.13 Reproductive Toxicity

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

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

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

Table 3.14 TOST: Single Exposure

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

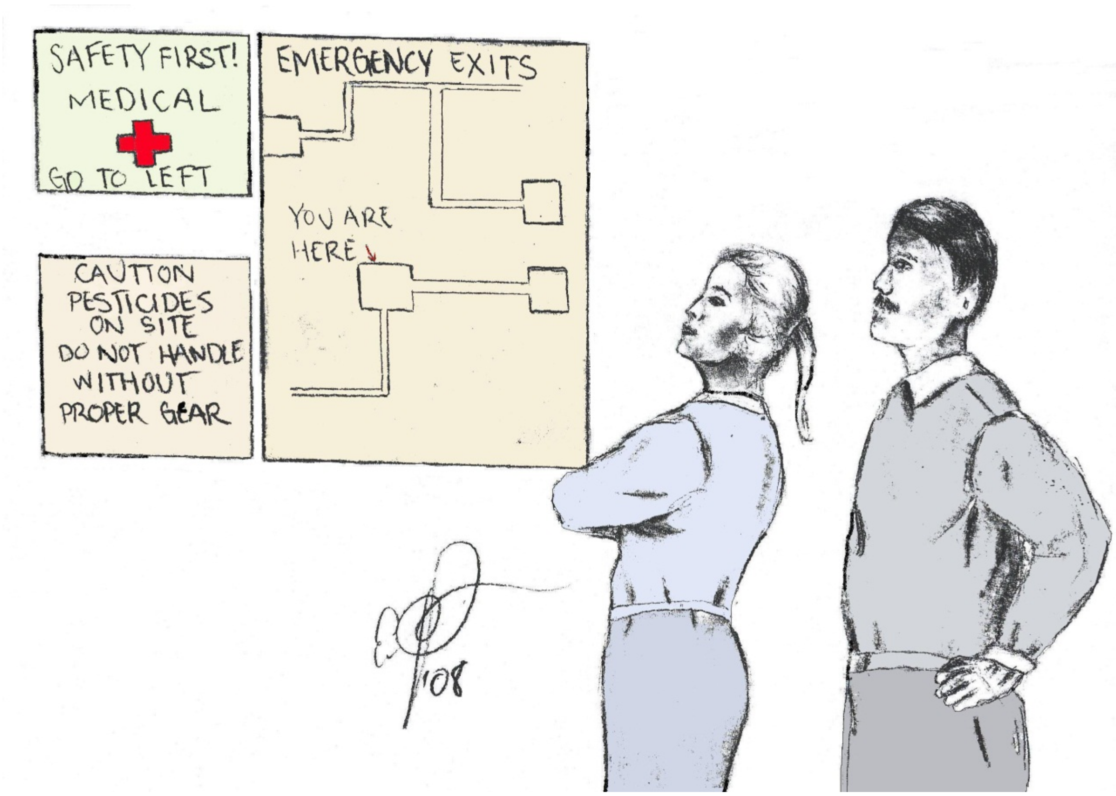
Substances and mixtures of the repeated exposure target organ toxicity hazard class are assigned to one of two hazard categories in Table 3.15.

Table 3.15 TOST: Repeated Exposure

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

In order to help reach a decision about whether a substance should be classified or not, and to what degree it would be classified (Category 1 vs. Category 2), dose/concentration 'guidance values' are provided in the GHS. The guidance values and ranges for single and repeated doses are intended only for guidance purposes.

This means that they are to be used as part of the weight of evidence approach, and to assist with decisions about classification. They are not intended as strict demarcation values. The guidance value for repeated dose effects refer to effects seen in a standard 90-day toxicity study conducted in rats. They can be used as a basis to extrapolate equivalent guidance values for toxicity studies of greater or lesser duration.



3.2.10 Aspiration Hazard

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

Table 3.16 Aspiration Toxicity

Category 1: Known (regarded) human	Category 2: Presumed human
- human evidence - hydrocarbons with kinematic viscosity ? 20.5 mm2/s at 40° C.	- Based on animal studies - surface tension, water solubility, boiling point - kinematic viscosity ? 14 mm2/s at 40°C & not Category 1

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

3.3 Environmental Hazards

3.3.1 Hazardous to the Aquatic Environment

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

3.3.1.1 Acute Aquatic Toxicity

Acute aquatic toxicity means the intrinsic property of a material to cause injury to an aquatic organism in a short-term exposure. Substances and mixtures of this hazard class are assigned to one of three toxicity categories on the basis of acute toxicity data: LC50 (fish) or EC50 (crustacea) or ErC50 (for algae or other aquatic plants). In some regulatory systems these acute toxicity categories may be subdivided or extended for certain sectors.

3.3.1.2 Chronic Aquatic Toxicity

Chronic aquatic toxicity means the potential or actual properties of a material to cause adverse effects to aquatic organisms during exposures that are determined in relation to the lifecycle of the organism. Substances and mixtures in this hazard class are assigned to one of four toxicity categories on the basis of acute data and environmental fate data: LC50 (fish) or EC50 (crustacea) or ErC50 (for algae or other aquatic plants) and degradation/bioaccumulation.

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

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

Table 3.17 Acute & Chronic Aquatic Toxicity

Acute Cat. I Acute toxicity ≤ 1.00 mg/l	Acute Cat. II Acute toxicity > 1.00 but ≤ 10.0 mg/l	Acute Cat. III Acute toxicity ≤ 10.0 but < 100 mg/l

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

3.4 What is the GHS approach to classifying mixtures?

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

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

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

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

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

Figure 3.4
Tier Approach to Classification of Mixtures

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

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

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

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

3.5 What are Bridging Principles?

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

Dilution: If a mixture is diluted with a diluent that has an equivalent or lower toxicity, then the hazards of the new mixture are assumed to be equivalent to the original.

Batching: If a batch of a complex substance is produced under a controlled process, then the hazards of the new batch are assumed to be equivalent to the previous batches.

Concentration of Highly Toxic Mixtures: If a mixture is severely hazardous, then a concentrated mixture is also assumed to be severely hazardous
Interpolation within One Toxic Category: Mixtures having component concentrations within a range where the hazards are known are assumed to have those known hazards.

Substantially Similar Mixtures: Slight changes in the concentrations of components are not expected to change the hazards of a mixture and substitutions involving toxicologically similar components are not expected to change the hazards of a mixture

Aerosols: An aerosol form of a mixture is assumed to have the same hazards as the tested, non-aerosolized form of the mixture unless the propellant affects the hazards upon spraying.

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

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

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

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

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

Figure 3.5 GHS Mixtures

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

	Formula & Summation Method	toxicity category, Substantially similar mixtures	

These chemical containers where cited in a recent unannounced OSHA inspection. The flammable chemicals were not "grounded and bonded" and notice that the Inspector is asking several related and unrelated questions to this employee.

4.0 Hazard Communication

Section 3, explained that classification is the starting point for the GHS. Once a chemical has been classified, the hazard(s) must be communicated to target audiences. As in existing systems, labels and Safety Data Sheets are the main tools for chemical hazard communication.

They identify the hazardous properties of chemicals that may pose a health, physical or environmental hazard during normal handling or use. The goal of the GHS is to identify the intrinsic hazards found in chemical substances and mixtures, and to convey information about these hazards.

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

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

The comprehensibility of the components of the system should take account of existing studies and literature as well as any evidence gained from testing;

The phrases used to indicate degree (severity) of hazard should be consistent across the health, physical and environmental hazards.

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

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

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

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

4.2 Labels

4.2.1 What does a label look like?

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

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

4.2.2 USA Examples:

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

Figure 4.1

ToxiFlam
TOXIC
COMBUSTIBLE LIQUID AND
VAPOR

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

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

Figure 4.2

ToxiFlam (Contains XYZ)

WARNING! HARMFUL IF SWALLOWED, FLAMMABLE LIQUID AND VAPOR

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

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

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

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

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

Consumer Products and Consumers

Figure 4.3
ToxiFlam
(Contains XYZ)

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

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

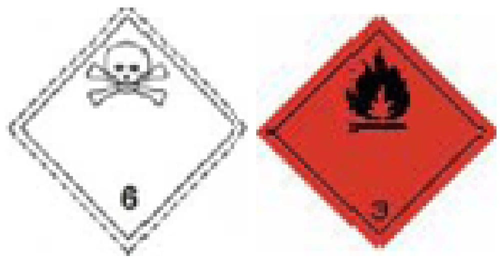
My Company, My Street, MyTown NJ 00000 Tel. 444 999 9999

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

Transport and Emergency Responders

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

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



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Agricultural Chemicals and Pesticides
In many systems, agricultural chemicals often have special label requirements. In the U.S. the EPA is the agency covering these chemicals. A pesticide product with the same hazards as ToxiFlam would have a label developed using FIFRA requirements. FIFRA has requirements for product identity, chemical identity, signal word, hazard statements, and precautionary measures including first aid.
Figure 4.5
ToxiFlam
Active/ Inerts: Contains XYZ %

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

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

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

4.2.3 International Examples

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

European Union Label

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

Figure 4.6
ToxiFlam (contains XYZ)

KEEP OUT OF THE REACH OF CHILDREN

Harmful If Swallowed. (R22)
Flammable. (R10)
Keep away from food, drink and animal feeding stuffs. (S13)
Wear suitable protective clothing. (S36)
If swallowed, seek medical advice immediately and show this
Container label. (S46)
In case of fire, use water, fog, $CO2$, or alcohol foam. (S43)

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Canadian Workplace Hazardous Materials Identification System (WHMIS) Label

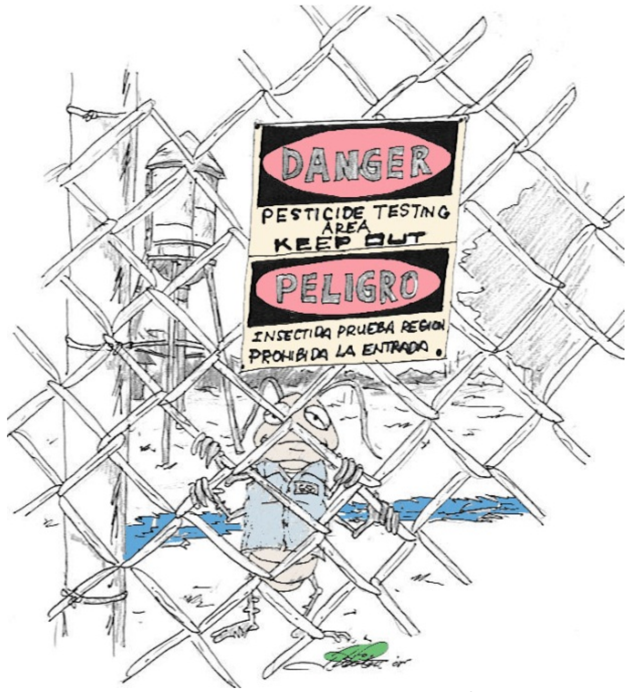
The WHMIS label requires product identifier, hazard symbol, hazard statement, precautionary measures, first aid, MSDS statement and supplier identification. In addition to these common label elements, WHMIS requires a hatched border.

Figure 4.7
ToxiFlam

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

4.3 What are the GHS label elements?

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



The standardized label elements included in the GHS are:
Symbols (hazard pictograms): Convey health, physical and environmental hazard information, assigned to a GHS hazard class and category.

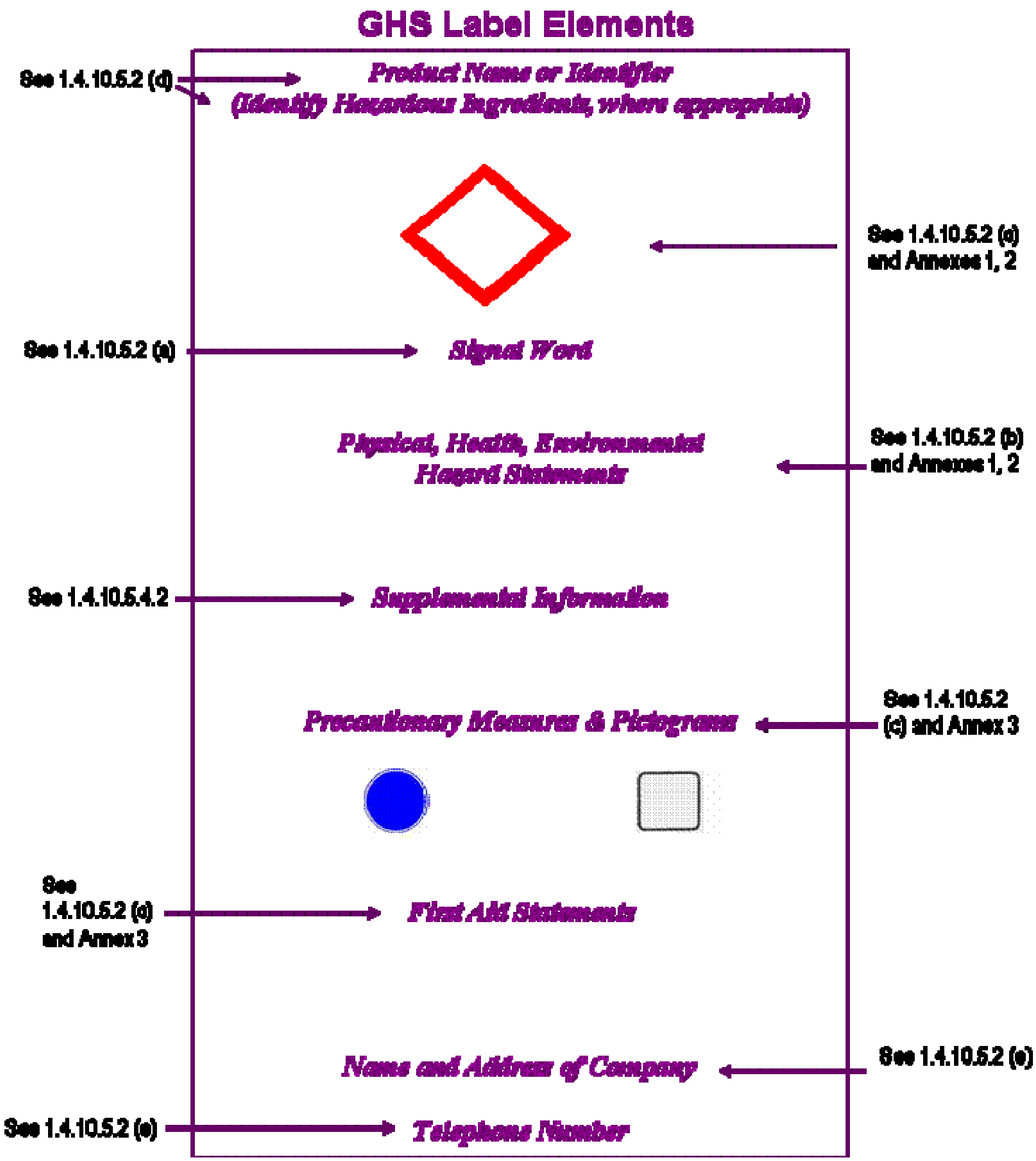
Signal Words: "Danger" or "Warning" are used to emphasize hazards and indicate the relative level of severity of the hazard, assigned to a GHS hazard class and category.

Hazard Statements: Standard phrases assigned to a hazard class and category that describe the nature of the hazard.

The symbols, signal words, and hazard statements have all been standardized and assigned to specific hazard categories and classes, as appropriate. This approach makes it easier for countries to implement the system and should make it easier for companies to comply with regulations based on the GHS.

The prescribed symbols, signal words, and hazard statements can be readily selected from Annex 1 of the GHS Purple Book. These standardized elements are not subject to variation, and should appear on the GHS label as indicated in the GHS for each hazard category/class in the system. The use of symbols, signal words or hazard statements other than those that have been assigned to each of the GHS hazards would be contrary to harmonization.

Figure 4.8



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

4.3.1 Symbols/Pictograms

The GHS symbols have been incorporated into pictograms for use on the GHS label. Pictograms include the harmonized hazard symbols plus other graphic elements, such as borders, background patterns or colors which are intended to convey specific information. For transport, pictograms (Table 4.10) will have the background, symbol and colors currently used in the UN Recommendations on the Transport of Dangerous Goods, Model Regulations. For other sectors, pictograms (Table 4.9) will have a black symbol on a white background with a red diamond frame. A black frame may be used for shipments within one country. Where a transport pictogram appears, the GHS pictogram for the same hazard should not appear.

4.3.2 Signal Words

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

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

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

4.3.3 Hazard Statements

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

Figure 4.9

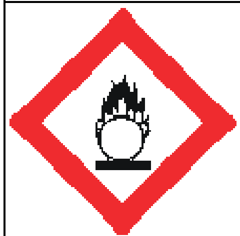
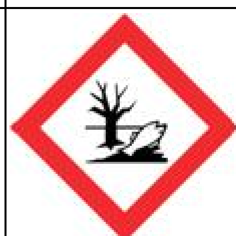
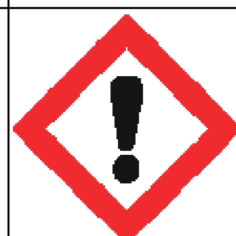
GHS Pictograms and Hazard Classes		
		
Oxidizers	Flammables Self Reactives Pyrophorics Self-Heating Emits Flammable Gas Organic Peroxides	Explosives Self Reactives Organic Peroxides
		
Acute toxicity (severe)	Corrosives	Gases Under Pressure
		
Carcinogen Respiratory Sensitizer Reproductive Toxicity Target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

Figure 4.10

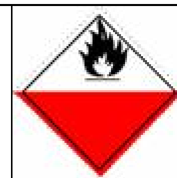
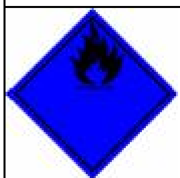
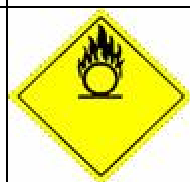
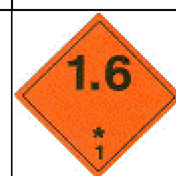
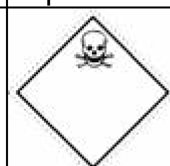
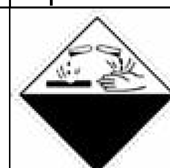
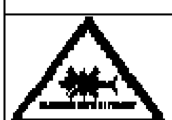
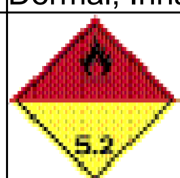
Transport "Pictograms"		
		
Flammable Liquid Flammable Gas Flammable Aerosol	Flammable solid Self-Reactive Substances	Pyrophorics (Spontaneously Combustible) Self-Heating Substances
		
Substances, which in contact with water, emit flammable gases (Dangerous When Wet)	Oxidizing Gases Oxidizing Liquids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

Figure 4.11

ACUTE ORAL TOXICITY - Annex 1					
	Category 1	Category 2	Category 3	Category 4	Category 5
LD50	Less 5 mg/kg	> 5 < 50 mg/kg	^{3} 50 < 300 mg/kg	^{3} 300 < 2000 mg/kg	^{3} 2000 < 5000 mg/kg
Pictogram					No symbol
Signal word	Danger	Danger	Danger	Warning	Warning
Hazard statement	Fatal if swallowed	Fatal if swallowed	Toxic if swallowed	Harmful if swallowed	May be harmful if swallowed

Other GHS label elements include:

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

4.3.4 Precautionary Statements and Pictograms

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

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

4.3.5 Product Identifier (Ingredient Disclosure)

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

The GHS label for a substance should include the chemical identity of the substance (name as determined by IUPAC, ISO, CAS or technical name). For mixtures/alloys, the label should include the chemical identities of all ingredients that contribute to acute toxicity, skin corrosion or serious eye damage, germ cell mutagenicity, carcinogenicity, reproductive toxicity, skin or respiratory sensitization, or Target Organ Systemic Toxicity (TOST), when these hazards appear on the label. Where a product is supplied exclusively for workplace use, the Competent Authority may give suppliers discretion to include chemical identities on the SDS, in lieu of including them on labels. The Competent Authority rules for confidential business information (CBI) take priority over the rules for product identification.

4.3.6 Supplier Identification

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

4.3.7 Supplemental Information

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

4.4 How are multiple hazards handled on labels?

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

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

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

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

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

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

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

ToxiFlam (Contains: XYZ)

Danger! Toxic If Swallowed, Flammable Liquid and Vapor

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

In case of fire, use water fog, dry chemical, CO2, or "alcohol" foam.
See Material Safety Data Sheet for further details regarding safe use of this product.

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

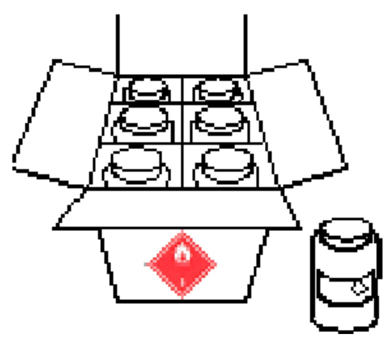


Figure 4.13 Combination Packaging (Outer box with inner bottles)

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

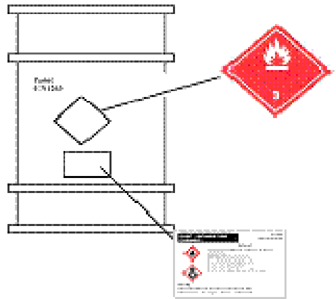


Figure 4.14 Combination Packaging (Outer box with inner bottles)

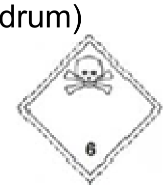
For a container such as a 55 gallon drum, the transport required markings and pictograms may be combined with the GHS label elements or presented separately. In Figure 4.14 a label arrangement for a single packaging such as a 55 gallon drum is shown. Pictograms and markings required by the transport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

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

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

ToxiFlam
Danger! Toxic If Swallowed
Flammable Liquid and Vapor

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



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

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

In case of fire, use water fog, dry chemical, CO2, or "alcohol" foam.

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

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

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

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

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

The revised Purple Book contains guidance on developing a GHS SDS (Annex 4). Other resources for SDSs include:
ILO Standard under the Recommendation 177 on Safety in the Use of Chemicals at Work, International Standard 11014-1 (1994) of the International Standard Organization (ISO) and ISO Safety Data Sheet for Chemical Products 11014-1: 2003 DRAFT,

Figure 4.14

Minimum information for an SDS

1.	Identification of the substance or mixture and of the supplier	GHS product identifier. Other means of identification. Recommended use of the chemical and restrictions on use. Supplier's details (including name, address, phone number, etc.). Emergency phone number.
2.	Hazards identification	GHS classification of the substance/mixture and any national or regional information. GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.
3.	Composition/information on ingredients	Substance Chemical identity. Common name, synonyms, etc. CAS number, EC number, etc. Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. Mixture The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cutoff levels. NOTE: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification.

4.	First aid measures	Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion. Most important symptoms/effects, acute and delayed. Indication of immediate medical attention and special treatment needed, if necessary.
5.	Firefighting measures	Suitable (and unsuitable) extinguishing media. Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). Special protective equipment and precautions for firefighters.
6.	Accidental release measures	Personal precautions, protective equipment and emergency procedures. Environmental precautions. Methods and materials for containment and cleaning up.
7.	Handling and storage	Precautions for safe handling. Conditions for safe storage, including any incompatibilities.
8.	Exposure controls/personal protection.	Control parameters, e.g., occupational exposure limit values or biological limit values. Appropriate engineering controls. Individual protection measures, such as personal protective equipment.
9.	Physical and chemical properties	Appearance (physical state, color, etc.). Odor. Odor threshold. pH. melting point/freezing point. initial boiling point and boiling range. flash point. evaporation rate. flammability (solid, gas). upper/lower flammability or explosive limits. vapor pressure. vapor density. relative density. solubility(ies). partition coefficient: n-octanol/water. autoignition temperature. decomposition temperature.

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

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

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

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

4.11 How does the GHS address Confidential Business Information (CBI)?
Confidential business information (CBI) will not be harmonized under the GHS. National authorities should establish appropriate mechanisms for CBI protection. The GHS established CBI principles which include:
CBI provisions should not compromise the health and safety of users;
CBI claims should be limited to the names of chemicals and their concentrations in mixtures;
Mechanisms should be established for disclosure in emergency and non-emergency situations.

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

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

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

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

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

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

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

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

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

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

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

How is the Safety Data Sheet (SDS) changing under the revised Hazard Communication Standard?
The information required on the safety data sheet (SDS) will remain essentially the same as that in the current standard. The current Hazard Communication Standard (HCS) indicates what information has to be included on an SDS but does not specify a format for presentation or order of information. The revised HCS requires that the information on the SDS is presented using consistent headings in a specified sequence. Paragraph (g) of the final rule indicates the headings of information to be included on the SDS and the order in which they are to be provided. In addition, Appendix D indicates what information is to be included under each heading. The SDS format is the same as the ANSI standard format which is widely used in the U.S. and is already familiar to many employees.

HCS Pictograms and Hazards

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

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

Section 1. Identification
Section 2. Hazard(s) identification
Section 3. Composition/information on ingredients
Section 4. First-Aid measures
Section 5. Fire-fighting measures
Section 6. Accidental release measures
Section 7. Handling and storage
Section 8. Exposure controls/personal protection
Section 9. Physical and chemical properties
Section 10. Stability and reactivity
Section 11. Toxicological information
Section 12. Ecological information
Section 13. Disposal considerations
Section 14. Transport information
Section 15. Regulatory information
Section 16. Other information, including date of preparation or last revision
Sections 12-15 may be included in the SDS, but are not required by OSHA.

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

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

Will the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) classifications be required on the Safety Data Sheet (SDS)?
OSHA has retained the requirement to include IARC and NTP classifications on safety data sheets (SDSs). Therefore, if a chemical is listed as a carcinogen by either IARC or NTP, it must be noted on the SDS. Additionally, if OSHA finds a chemical to be a carcinogen, it must be noted on the SDS as well.

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

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

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

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

Combustible dust:
OSHA has not provided a definition for combustible dust to the final HCS given ongoing activities in the specific rulemaking, as well as in the United Nations Sub-Committee of Experts on the GHS (UN/SCEGHS). However, guidance is being provided through existing documents, including the Combustible Dust National Emphasis Program Directive CPL 03-00-008, which includes an operative definition, as well as provides information about current responsibilities in this area. In addition, there are a number of voluntary industry consensus standards (particularly those of the NFPA) that address combustible dust.

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

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

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

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

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

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

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

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

The NEW OSHA Hazard Communication Standard (HCS)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1910.1200(b)(4)(iii)
Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section), to the extent

necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chemical means any substance, or mixture of substances.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1910.1200(d)

Hazard classification.

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

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

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

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

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

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

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

1910.1200(d)(4)(iii)
29 CFR part 1910, subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.
Note: The Registry of Toxic Effects of Chemical Substances published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

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

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

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

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

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

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

1910.1200(e)

Written hazard communication program.

1910.1200(e)(1)

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

1910.1200(e)(1)(i)

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

1910.1200(e)(1)(ii)

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

1910.1200(e)(2)

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

1910.1200(e)(2)(i)

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

1910.1200(e)(2)(ii)

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

1910.1200(e)(2)(iii)

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

1910.1200(e)(3)

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

1910.1200(e)(4)

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

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

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

1910.1200(f)(1)(i)
Product identifier;
1910.1200(f)(1)(ii)
Signal word;
1910.1200(f)(1)(iii)
Hazard statement(s);
1910.1200(f)(1)(iv)
Pictogram(s);
1910.1200(f)(1)(v)
Precautionary statement(s); and,
1910.1200(f)(1)(vi)
Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

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

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

1910.1200(f)(4)
Solid materials.
1910.1200(f)(4)(i)
For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

1910.1200(f)(4)(ii)
The label may be transmitted with the initial shipment itself, or with the safety data sheet that is to be provided prior to or at the time of the first shipment; and,

1910.1200(f)(4)(iii)
This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself, and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grains).

1910.1200(f)(5)
Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.) and regulations issued under that Act by the Department of Transportation.

1910.1200(f)(6)
Workplace labeling. Except as provided in paragraphs (f)(7) and (f)(8) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with either:

1910.1200(f)(6)(i)
The information specified under paragraphs (f)(1)(i) through (v) of this section for labels on shipped containers; or,

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

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

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

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

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

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

1910.1200(g)

Safety data sheets.

1910.1200(g)(1)

Chemical manufacturers and importers shall obtain or develop a safety data sheet for each hazardous chemical they produce or import. Employers shall have a safety data sheet in the workplace for each hazardous chemical which they use.

1910.1200(g)(2)

The chemical manufacturer or importer preparing the safety data sheet shall ensure that it is in English (although the employer may maintain copies in other languages as well), and includes at least the following section numbers and headings, and associated information under each heading, in the order listed (See Appendix D to § 1910.1200—Safety Data Sheets, for the specific content of each section of the safety data sheet):

1910.1200(g)(2)(i)
Section 1, Identification;
1910.1200(g)(2)(ii)
Section 2, Hazard(s) identification;
1910.1200(g)(2)(iii)
Section 3, Composition/information on ingredients;
1910.1200(g)(2)(iv)
Section 4, First-aid measures;
1910.1200(g)(2)(v)
Section 5, Fire-fighting measures;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1910.1200(h)

Employee information and training.

1910.1200(h)(1)
Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new chemical hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and safety data sheets.

1910.1200(h)(2)
Information. Employees shall be informed of:
1910.1200(h)(2)(i)
The requirements of this section;
1910.1200(h)(2)(ii)
Any operations in their work area where hazardous chemicals are present; and,
1910.1200(h)(2)(iii)
The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and safety data sheets required by this section.

1910. 1910.1200(f)(11)1200(h)(3)

Training. Employee training shall include at least:

1910.1200(h)(3)(i)
Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

1910.1200(h)(3)(ii)
The physical, health, simple asphyxiation, combustible dust, and pyrophoric gas hazards, as well as hazards not otherwise classified, of the chemicals in the work area;

1910.1200(h)(3)(iii)
The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

1910.1200(h)(3)(iv)
The details of the hazard communication program developed by the employer, including an explanation of the labels received on shipped containers and the workplace labeling system used by their employer; the safety data sheet, including the order of information and how employees can obtain and use the appropriate hazard information.

1910.1200(i)
Trade secrets.
1910.1200(i)(1)
The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name, other specific identification of a hazardous chemical, or the exact percentage (concentration) of the substance in a mixture, from the safety data sheet, provided that:
1910.1200(i)(1)(i)
The claim that the information withheld is a trade secret can be supported;
1910.1200(i)(1)(ii)
Information contained in the safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;
1910.1200(i)(1)(iii)
The safety data sheet indicates that the specific chemical identity and/or percentage of composition is being withheld as a trade secret; and,
1910.1200(i)(1)(iv)
The specific chemical identity and percentage is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph (i).
1910.1200(i)(2)
Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity and/or specific percentage of composition of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity or percentage composition of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer,

or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.
1910.1200(i)(3)
In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity or percentage composition, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:
1910.1200(i)(3)(i)
The request is in writing;
1910.1200(i)(3)(ii)
The request describes with reasonable detail one or more of the following occupational health needs for the information:
1910.1200(i)(3)(ii)(A)
To assess the hazards of the chemicals to which employees will be exposed;
1910.1200(i)(3)(ii)(B)
To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;
1910.1200(i)(3)(ii)(C)
To conduct pre-assignment or periodic medical surveillance of exposed employees;
1910.1200(i)(3)(ii)(D)
To provide medical treatment to exposed employees;
1910.1200(i)(3)(ii)(E)
To select or assess appropriate personal protective equipment for exposed employees;
1910.1200(i)(3)(ii)(F)
To design or assess engineering controls or other protective measures for exposed employees; and,
1910.1200(i)(3)(ii)(G)
To conduct studies to determine the health effects of exposure.
1910.1200(i)(3)(iii)
The request explains in detail why the disclosure of the specific chemical identity or percentage composition is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:
1910.1200(i)(3)(iii)(A)
The properties and effects of the chemical;
1910.1200(i)(3)(iii)(B)
Measures for controlling workers' exposure to the chemical;
1910.1200(i)(3)(iii)(C)
Methods of monitoring and analyzing worker exposure to the chemical; and,
1910.1200(i)(3)(iii)(D)
Methods of diagnosing and treating harmful exposures to the chemical;
1910.1200(i)(3)(iv)
The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,
1910.1200(i)(3)(v)
The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health

professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.
1910.1200(i)(4)
The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:
1910.1200(i)(4)(i)
May restrict the use of the information to the health purposes indicated in the written statement of need;
1910.1200(i)(4)(ii)
May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,
1910.1200(i)(4)(iii)
May not include requirements for the posting of a penalty bond.
1910.1200(i)(5)
Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.
1910.1200(i)(6)
If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

1910.1200(i)(7)
If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity or percentage composition, the denial must:
1910.1200(i)(7)(i)
Be provided to the health professional, employee, or designated representative, within thirty days of the request;
1910.1200(i)(7)(ii)
Be in writing;
1910.1200(i)(7)(iii)
Include evidence to support the claim that the specific chemical identity or percent of composition is a trade secret;
1910.1200(i)(7)(iv)
State the specific reasons why the request is being denied; and,
1910.1200(i)(7)(v)
Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the trade secret.

1910.1200(i)(8)
The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

1910.1200(i)(9)
When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:
1910.1200(i)(9)(i)

The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity or percentage composition is a trade secret;
1910.1200(i)(9)(ii)
The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,
1910.1200(i)(9)(iii)
The health professional, employee or designated representative has demonstrated adequate means to protect the confidentiality.

1910.1200(i)(10)(i)
If OSHA determines that the specific chemical identity or percentage composition requested under paragraph (i)(3) of this section is not a "bona fide" trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

1910.1200(i)(10)(ii)
If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

1910.1200(i)(11)
If a citation for a failure to release trade secret information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation "in camera" or issue appropriate orders to protect the confidentiality of such matters.

1910.1200(i)(12)
Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

1910.1200(i)(13)
Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process information which is a trade secret.

1910.1200(j)
Effective dates.
1910.1200(j)(1)
Employers shall train employees regarding the new label elements and safety data sheets format by December 1, 2013.

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

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

Different Types of Chemical Hazards
Chemicals cause health hazards if they are:

Target organ chemicals—they injure specific organs in your body.
Toxic—cause illness or death. Toxic chemicals are determined on the basis of tests on laboratory animals that are exposed to a given chemical through either inhalation, ingestion, or skin absorption.
Corrosive—can destroy your skin or eyes.
Irritants—cause reversible inflammation when they make contact with living tissue.
Carcinogens—have been known to cause cancer or have the potential of causing cancer in humans.
Sensitizers—can cause an allergic reaction on subsequent repeated exposures.
Neurotoxins—produce toxic effects primarily on the central nervous system.
Nephrotoxins—Produce toxic effects on kidneys.
Reproductive toxins—have the potential to adversely affect the reproductive system.
Hepatotoxins—can adversely affect the liver.
Lung hazards—can irritate or damage pulmonary tissue.
Skin hazards—can affect the dermal layer of the body, resulting in rashes and irritation.
Eye hazards—can adversely affect the eye or diminish the visual capacity of a human.
Blood system hazards—caused by chemicals that decrease the hemoglobin function; depriving of oxygen. Chemicals that present physical hazards and are covered by the Hazard Communication Standard include combustible liquids, flammable materials, all compressed gases, explosives, organic peroxides, oxidizers, pyrophoric materials, unstable materials, and water-reactive materials.
Fire hazards—chemicals that have the potential for creating a fire or aiding an ongoing fire. These materials are flammables, combustibles, oxidizers, pyrophoric materials, and organic peroxides.
Flammables—catch fire quickly.
Oxidizers—capable of initiating or promoting a fire in other compounds by the release of oxygen or other gases.
Pyrophoric materials—can be ignited as a result of contact with oxygen in the absence of an ignition source at temperature below 130°F.
Organic peroxides—contain both fuel, in the form of carbon, and excess oxygen, and thus can pose a severe fire hazard.
Compressed gases—all compressed gases pose a physical hazard.
Explosive materials—can be decomposed in a violent chemical reaction with the production of heat, pressure, and large quantities of gas.
Unstable materials—certain compounds in their pure form can undergo vigorous decomposition or polymerization under moderate conditions of shock, pressure, or temperature.
Water-reactive compounds—can react vigorously with water to produce a toxic or flammable gas.

Identifying Hazardous Chemicals

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

Label Information

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

The label may use words or symbols to tell you:

The chemical's identity and its components (unless they're part of the manufacturer's trade secrets, which do not have to be revealed)

The name and address of the company that made or imported the chemical

Specific hazard warnings, such as physical or health hazards. Labels may also include:

Precautionary measures, such as basic protective clothing, equipment, and procedures to work safely

Proper handling and storage instructions

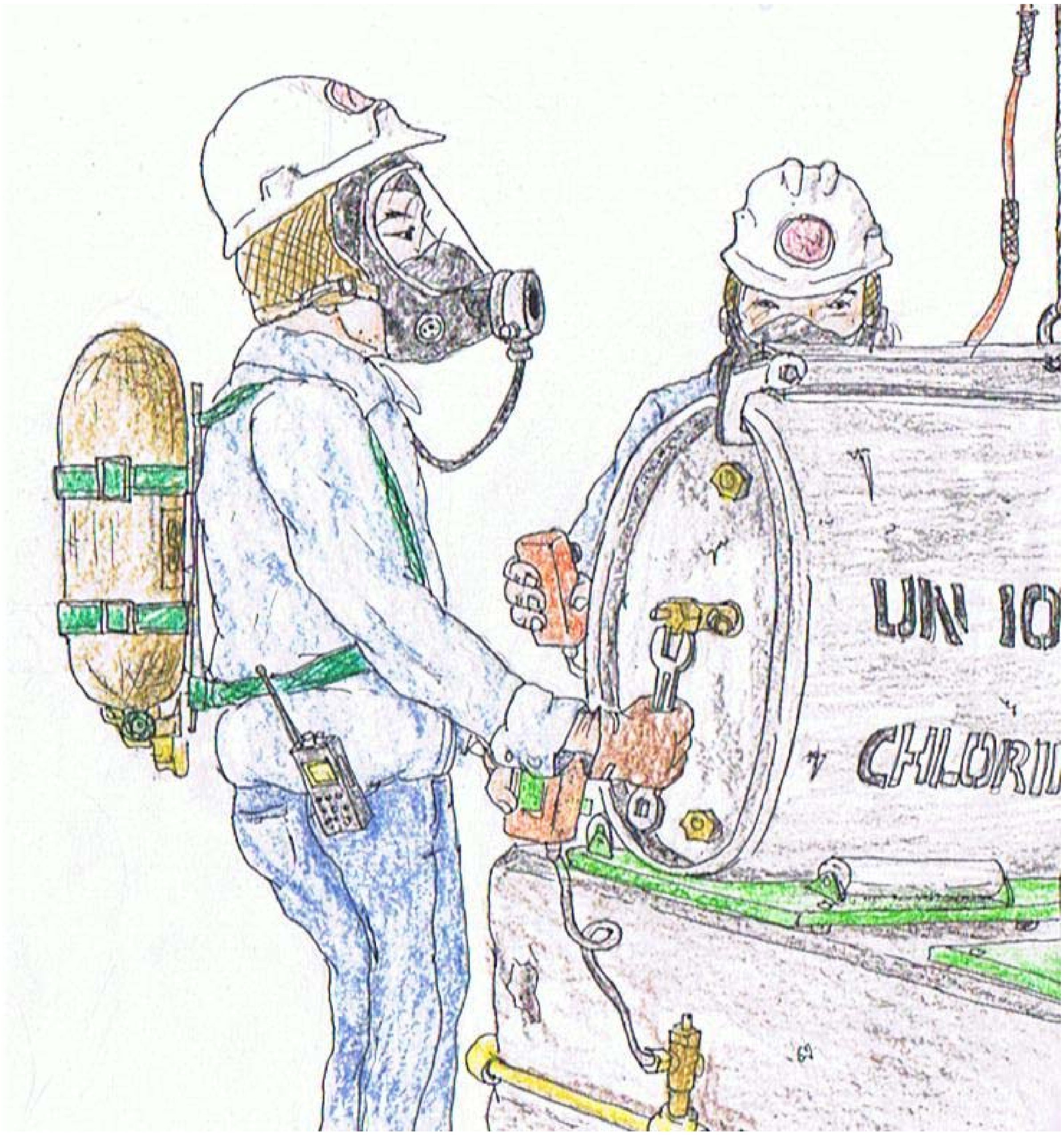
First-aid instructions

Special instructions concerning children

SDS Information

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

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



Fire, Explosion, and Reactivity Hazards

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

Flammable chemicals—catch fire easily. The MSDS will tell if it's flammable.

Flash point—the minimum temperature at which a liquid gives off enough vapors to burn. The lower the flash point, the more flammable the substance.

Flammable limits—the range of concentration of a substance in the air within which a substance can readily catch fire. Concentrations below or above the limits are less likely to ignite or burn.

Common SDS Definitions

Health Hazards

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Physical Hazards

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Hazardous Limits

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

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

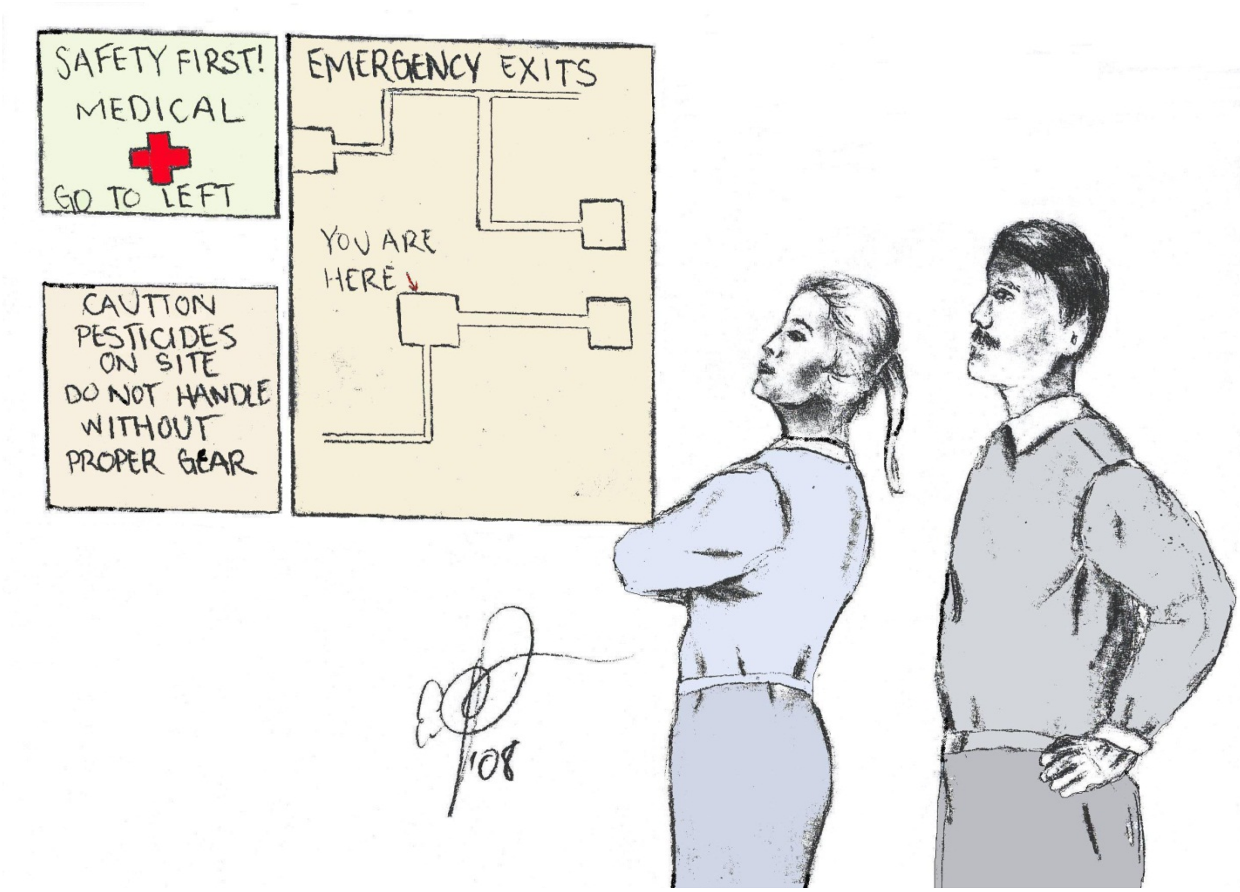
permissible exposure limit (PEL): the averaged maximum concentration of a chemical in the air that a person can be exposed to repeatedly without developing health problems. Generally expressed in parts per million (ppm). Concentrations at or above the PEL make respiratory protection mandatory.

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

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

Laboratory Use of Hazardous Chemicals Section

Always utilize a fume hood.



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

Laboratory Use of Hazardous Chemicals Requirements

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

Emergency and Personal Protection Training

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

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

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

OSHA requires that laboratory employees be informed of:

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

OSHA also requires that laboratory employees be trained in

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

Questions

1. Name some potential hazards associated with laboratory chemicals.

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

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

Controlling Chemical Exposures

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

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

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

Inhalation

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

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

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

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

OSHA Respirator Standard

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

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

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

Administrative controls to reduce skin/eye contact exposure include:

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

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

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

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

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

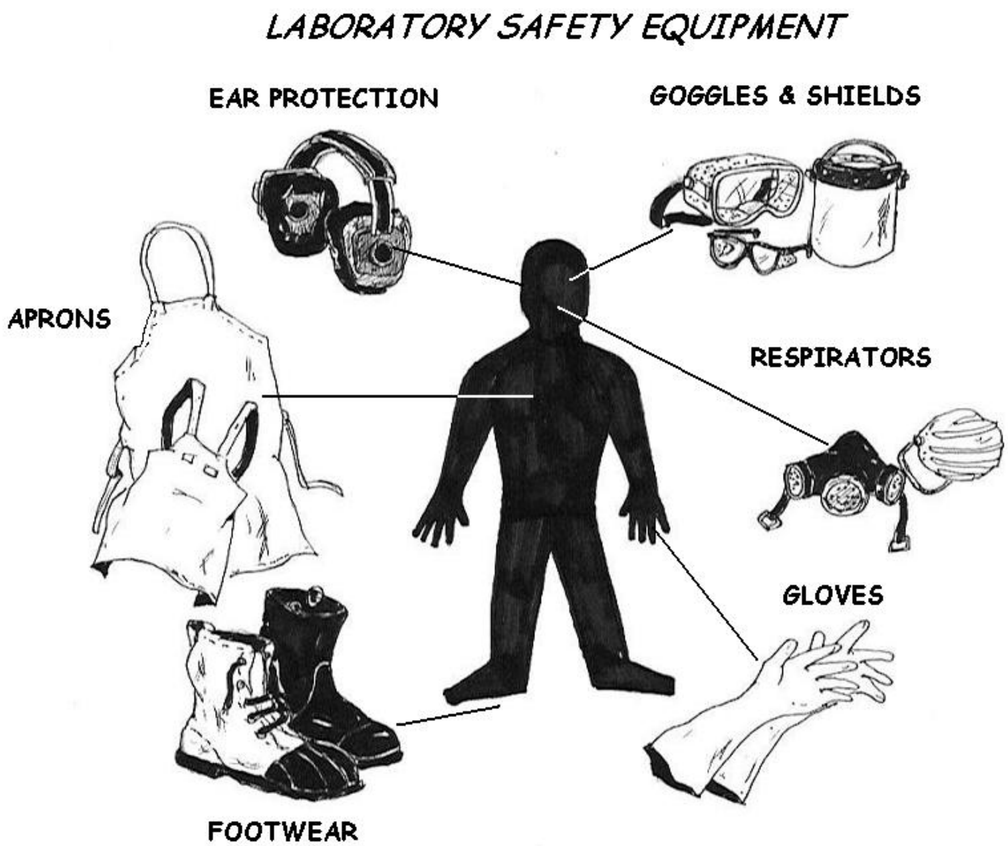
Red boxes will be used to collect all used needles and syringes. Separate collection containers will be used to collect broken glass. Label the containers, "**CAUTION - Broken Glass**".

See also your Laboratory Waste Management Procedures.

Personal Protection Equipment Section

How do you handle pesticides or herbicides at your facility?

TOXIC: Refers to a chemical falling within any of the following toxic categories:
1. A chemical that has a median lethal dose (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 weighing between 200 and 300 milligrams each.
2. A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram, but not more than 1000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million, but not more than 2000 parts per million by volume of gas or vapor, or more than two milligrams per liter, but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.



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

Personal Protective Equipment

Purpose

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

General Rules

Design

All personal protective equipment shall be of safe design and construction for the work to be performed.

Hazard Assessment and Equipment Selection

Hazard analysis procedures shall be used to assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the following actions will be taken:

1) Select, and have each affected Employee use, the proper PPE.

2) Communicate selection decisions to each affected Employee.

3) Select PPE that properly fit each affected employee.

Defective and damaged equipment.

Defective or damaged personal protective equipment shall not be used.

Training

All Employees who are required to use PPE shall be trained to know at least the following:

1) When PPE is necessary.
2) What PPE is necessary.
3) How to properly don, remove, adjust, and wear PPE.
4) The limitations of the PPE.
5) The proper care, maintenance, useful life and disposal of the PPE.

Each affected Employee shall demonstrate an understanding of the training and the ability to use PPE properly before being allowed to perform work requiring the use of PPE.

Certification of training for PPE is required by OSHA and shall be accomplished by using the Job Safety Checklist to verify that each affected Employee has received and understood the required PPE training.

Personal Protective Equipment Selection

Controlling Hazards

PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound manufacturing practices.

Selection Guidelines

The general procedure for selection of protective equipment is to:

a) become familiar with the potential hazards and the type of protective equipment that is available, and what it can do; i.e., splash protection, impact protection, etc.
b) compare the hazards associated with the environment; i.e., impact velocities, masses, projectile shape, radiation intensities, with the capabilities of the available protective equipment;
c) select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards
d) fit the user with the protective device and give instructions on care and use of the PPE. It is very important that end users be made aware of all warning labels for and limitations of their PPE.

Fitting the Device

Careful consideration must be given to comfort and fit. PPE that fits poorly will not afford the necessary protection. Continued wearing of the device is more likely if it fits the wearer comfortably. Protective devices are generally available in a variety of sizes. Care should be taken to ensure that the right size is selected.

Devices with Adjustable Features

Adjustments should be made on an individual basis for a comfortable fit that will maintain the protective device in the proper position. Particular care should be taken in fitting devices for eye protection against dust and chemical splash to ensure that the devices are sealed to the face. In addition, proper fitting of helmets is important to ensure that it will not fall off during work operations. In some cases a chin strap may be necessary to keep the helmet on an employee's head. (Chin straps should break at a reasonably low force, however, so as to prevent a strangulation hazard). Where manufacturer's instructions are available, they should be followed carefully.

Eye and Face Protection

Each affected employee shall use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

Each affected employee shall use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors are acceptable.

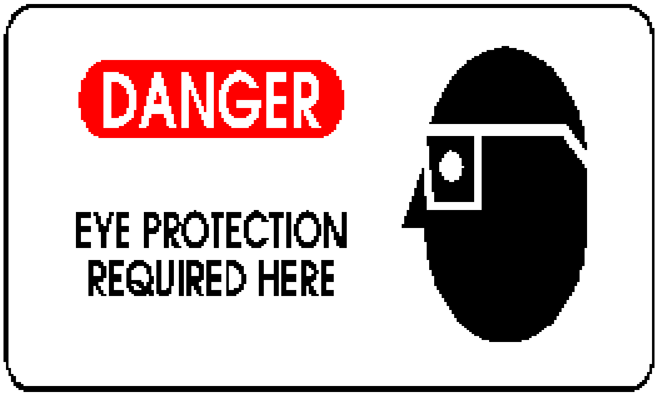
Each affected employee who wears prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or shall wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

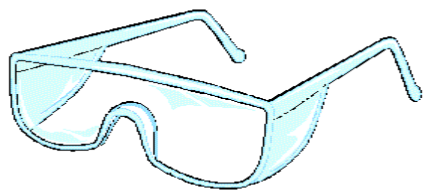
Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.

Each affected employee shall use equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. The following is a listing of appropriate shade numbers for various operations.

Filter Lenses for Protection Against Radiant Energy			
Operations	**Electrode Size 1/32 in**	**Arc Current**	**Protective Shade**
Shielded metal arc welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Torch brazing			3
Torch soldering			2
Note: as a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.			

Eye Protection is a Requirement When Working With Hazardous Materials

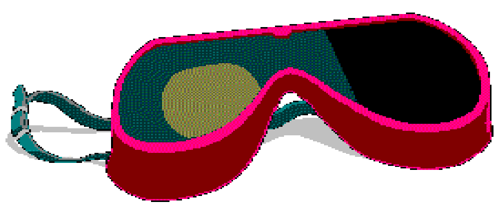




Safety Glasses (spectacles)

Safety glasses (spectacles) with side shields are the minimum level of eye protection required for any type of work with or around hazardous chemicals or chemical products.

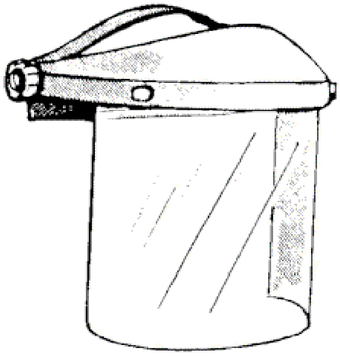
- Prescription glasses (with or without side shields) are not an acceptable substitution for safety glasses. Prescription safety glasses are available.
- Safety glasses do not provide complete protection against splash or spray because they do not fit tightly to your face.
- Safety glasses must meet ANSI Z87.1 standards (It will be marked on the frame).
- Safety glasses must be worn anytime chemicals or chemical products are handled.



Goggles, Splash (indirect venting)

Splash goggles are your next level of defense against chemical eye injury. Splash goggles have indirect ventilation and form a tight seal to the face.

- Splash goggle must be worn anytime there is the chance of a chemical splash or spray.
- Safety glasses are not an acceptable substitution for goggles and do not provide complete protection against splash or spray because they do not fit tightly to your face.
- Operations requiring goggles include but are not limited to pouring, scrubbing, rinsing, spraying (aerosols), washing, and dispensing.
- Splash goggles must also meet ANSI Z87.1 standards.



Face Shield

Face shields protect the eyes, face, and neck from chemical splashes and spray as well as flying particles.

- Face shields will not be worn independently. In other words, safety glasses or goggles must be worn underneath face shields for complete protection.
- Face shields are necessary anytime there is a severe risk of splash or spray or if the material in use is highly hazardous, for example highly corrosive alkaline material.

He should be wearing eye and hand protection.

Selection chart guidelines for eye and face protection

The following chart provides general guidance for the proper selection of eye and face protection to protect against hazards associated with the listed hazard "***source***" operations.

Source	Hazard	Protection
IMPACT - Chipping, grinding machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Spectacles with side protection, goggles, face shield For severe exposure, use face shield
HEAT-Furnace operation and arc welding	Hot sparks	Face shields, spectacles with side. For severe exposure use faceshield.
CHEMICALS-Acid and chemical handling, degreasing, plating	Splash	Goggles, eyecup and cover types. For severe exposure, use face shield.
DUST - Woodworking, buffing, general, buffing, general dusty conditions.	Nuisance dust	Goggles, eye cup and cover type

Selection Guidelines for Head Protection

All head protection is designed to provide protection from impact and penetration hazards caused by falling objects. Head protection is also available which provides protection from electric shock and burn. When selecting head protection, knowledge of potential electrical hazards is important.

Class A helmets, in addition to impact and penetration resistance, provide electrical protection from low-voltage conductors (they are proof tested to 2,200 volts).
Class B helmets, in addition to impact and penetration resistance; provide electrical protection from high-voltage conductors (they are proof tested to 20,000 volts).
Class C helmets provide impact and penetration resistance (they are usually made of aluminum which conducts electricity), and should not be used around electrical hazards.

Where falling object hazards are present, helmets must be worn. Some examples include: working below other workers who are using tools and materials which could fall; working around or under conveyor belts which are carrying parts or materials; working below machinery or processes which might cause material or objects to fall; and working on exposed energized conductors.

Foot Protection
General Requirements
Each affected employee shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where employee's feet are exposed to electrical hazards.

Selection Guidelines for Foot Protection
Safety shoes and boots provide both impact and compression protection. Where necessary, safety shoes can be obtained which provide puncture protection. In some work situations, metatarsal protection should be provided, and in other special situations electrical conductive or insulating safety shoes would be appropriate.

Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and, for other activities where objects might fall onto the feet.

Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts), around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet.

Safety shoes or boots with puncture protection would be required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees, causing a foot injury.

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

Hand Protection

General Requirements

Hand protection is required when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.

Selection guidelines for hand protection

Selection of hand PPE shall be based on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified. Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure.

There is no glove that provides protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. Before purchasing gloves, request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated. Other factors to be considered for glove selection in general include:

(A) As long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly change cheaper gloves than to reuse more expensive types.

(B) The work activities of the employee should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure of the hazard, and the physical stresses that will be applied.

Selection of gloves for protection against chemical hazards:

(A) The toxic properties of the chemical(s) must be determined; in particular, the ability of the chemical to cause local effects on the skin and/or to pass through the skin and cause systemic effects.

(B) Generally, any "**chemical resistant**" glove can be used for dry powders;

(C) For mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials.

(D) Employees must be able to remove the gloves in such a manner as to prevent skin contamination.

✔	Personal Protective Equipment[1]
	Chemical and disease protection
	Aprons
	Eye/Face splash guards
	Gloves (vinyl and/or latex or nitrile). Sizes: S M L XL
	Protective suits. Sizes: S M L XL
	Respirators (certification required for use)
	Climatic and UV protection
	Boots
	Fluids (for example, water and sports drinks)
	Hat, wide-brimmed
	Insect repellent (unscented)
	Rain gear
	Sunglasses
	Sunscreen
	Temperature-modifying clothing
	Flotation and reflective protection
	Orange flotation vests and jackets
	Safety harness
	Protection for working around heavy objects and machinery
	Back belt
	Hardhat
	Hearing protection
	Safety glasses
	Steel-toed safety boots
	Work gloves

[1] PPE must be selected based on the hazards likely to be encountered. The USGS is required to supply appropriate PPE, and field personnel are required to use it

Protective Clothing Applications

A. The purpose of chemical protective clothing and equipment is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered during hazardous materials operations. During chemical operations, it is not always apparent when exposure occurs. Many chemicals pose invisible hazards and offer no warning properties.

B. These guidelines describe the various types of clothing that are appropriate for use in various chemical operations, and provides recommendations in their selection and use. The final paragraph discusses heat stress and other key physiological factors that must be considered in connection with protective clothing use.

C. It is important that protective clothing users realize that no single combination of protective equipment and clothing is capable of protecting you against all hazards. Thus protective clothing should be used in conjunction with other protective methods. For example, engineering or administrative controls to limit chemical contact with personnel should always be considered as an alternative measure for preventing chemical exposure.

The use of protective clothing can itself create significant wearer hazards, such as heat stress, physical and psychological stress, in addition to impaired vision, mobility, and communication. In general, the greater the level of chemical protective clothing, the greater the associated risks. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. Overprotection as well as under-protection can be hazardous and should be avoided.

II. DESCRIPTIONS.
A. PROTECTIVE CLOTHING APPLICATIONS.

1. Protective clothing must be worn whenever the wearer faces potential hazards arising from chemical exposure. Some examples include:

- ➢ Emergency response;
- ➢ Chemical manufacturing and process industries;
- ➢ Hazardous waste site cleanup and disposal;
- ➢ Asbestos removal and other particulate operations; and
- ➢ Agricultural application of pesticides.

2. Within each application, there are several operations which require chemical protective clothing. For example, in emergency response, the following activities dictate chemical protective clothing use:

- ✓ **Site Survey**: The initial investigation of a hazardous materials incident; these situations are usually characterized by a large degree of uncertainty and mandate the highest levels of protection.

- ✓ **Rescue**: Entering a hazardous materials area for the purpose of removing an exposure victim; special considerations must be given to the contamination of the victim and to how the selected protective clothing may affect the ability of the wearer to carry out rescue.

- ✓ **Spill Mitigation**: Entering a hazardous materials area to prevent a potential spill or to reduce the hazards from an existing spill (i.e., applying a chlorine kit on railroad tank car). Protective clothing must accommodate the required tasks without sacrificing adequate protection.

- ✓ **Emergency Monitoring**: Outfitting personnel in protective clothing for the primary purpose of observing a hazardous materials incident without entry into the spill site. This may be applied to monitoring contract activity for spill cleanup.

- ✓ **Decontamination**: Applying decontamination procedures to personnel or equipment leaving the site; in general, a lower level of protective clothing is used by personnel involved in decontamination.

B. THE CLOTHING ENSEMBLE. The approach in selecting personal protective clothing must encompass an "**ensemble**" of clothing and equipment items which are easily integrated to provide both an appropriate level of protection and still allow one to carry out activities involving chemicals.

In many cases, simple protective clothing by itself may be sufficient to prevent chemical exposure, such as wearing gloves in combination with a splash apron and faceshield (or safety goggles).

1. The following is a checklist of components that may form the chemical protective ensemble:
   - ➢ Protective clothing (suit, coveralls, hoods, gloves, boots);
   - ➢ Respiratory equipment (SCBA, combination SCBA/SAR, air purifying respirators);
   - ➢ Cooling system (ice vest, air circulation, water circulation);
   - ➢ Communications device;
   - ➢ Head protection;
   - ➢ Eye protection;
   - ➢ Ear protection;
   - ➢ Inner garment; and
   - ➢ Outer protection (overgloves, overboots, flashcover).

2**. Factors that affect the selection of ensemble components include:**

- ✓ How each item accommodates the integration of other ensemble components. Some ensemble components may be incompatible due to how they are worn (e.g., some SCBA's may not fit within a particular chemical protective suit or allow acceptable mobility when worn).

- ✓ The ease of interfacing ensemble components without sacrificing required performance (e.g. a poorly fitting overglove that greatly reduces wearer dexterity).

- ✓ Limiting the number of equipment items to reduce donning time and complexity (e.g. some communications devices are built into SCBA's which as a unit are NIOSH certified).

C. LEVEL OF PROTECTION.

1. Table VIII:1-1 lists ensemble components based on the widely used EPA Levels of Protection: Levels A, B, C, and D. These lists can be used as the starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection.

For example, if an emergency response activity involves a highly contaminated area or if the potential of contamination is high, it may be advisable to wear a disposable covering such as Tyvek coveralls or PVC splash suits, over the protective ensemble.

TABLE VIII:1-1. EPA LEVELS OF PROTECTION

LEVEL A:

Vapor protective suit (meets NFPA 1991)

Pressure-demand, full-face SCBA

Inner chemical-resistant gloves, chemical-resistant safety boots, two-way radio communication

OPTIONAL: Cooling system, outer gloves, hard hat

Protection Provided: Highest available level of respiratory, skin, and eye protection from solid, liquid and gaseous chemicals.

Used When: The chemical(s) have been identified and have high level of hazards to respiratory system, skin and eyes. Substances are present with known or suspected skin toxicity or carcinogenity. Operations must be conducted in confined or poorly ventilated areas.

Limitations: Protective clothing must resist permeation by the chemical or mixtures present. Ensemble items must allow integration without loss of performance.

LEVEL B:

Liquid splash-protective suit (meets NFPA 1992)

Pressure-demand, full-facepiece SCBA

Inner chemical-resistant gloves, chemical-resistant safety boots, two-way radio communications

Hard hat.

OPTIONAL: Cooling system, outer gloves

Protection Provided: Provides same level of respiratory protection as Level A, but less skin protection. Liquid splash protection, but no protection against chemical vapors or gases.

Used When: The chemical(s) have been identified but do not require a high level of skin protection. Initial site surveys are required until higher levels of hazards are identified. The primary hazards associated with site entry are from liquid and not vapor contact.

Limitations: Protective clothing items must resist penetration by the chemicals or mixtures present. Ensemble items must allow integration without loss of performance.

LEVEL C:

Support Function Protective Garment (meets NFPA 1993)

Full-facepiece, air-purifying, canister-equipped respirator

Chemical resistant gloves and safety boots

Two-way communications system, hard hat

OPTIONAL: Faceshield, escape SCBA

Protection Provided: The same level of skin protection as Level B, but a lower level of respiratory protection. Liquid splash protection but no protection to chemical vapors or gases.

Used When: Contact with site chemical(s) will not affect the skin. Air contaminants have been identified and concentrations measured. A canister is available which can remove the contaminant. The site and its hazards have been completely characterized.

Limitations: Protective clothing items must resist penetration by the chemical or mixtures present. Chemical airborne concentration must be less than IDLH levels. The atmosphere must contain at least 19.5% oxygen.
Not Acceptable for Chemical Emergency Response

LEVEL D:
Coveralls, safety boots/shoes, safety glasses or chemical splash goggles
OPTIONAL: Gloves, escape SCBA, face-shield
Protection Provided: No respiratory protection, minimal skin protection.
Used When: The atmosphere contains no known hazard. Work functions preclude splashes, immersion, potential for inhalation, or direct contact with hazard chemicals.
Limitations: This level should not be worn in the Hot Zone. The atmosphere must contain at least 19.5% oxygen.
Not Acceptable for Chemical Emergency Response

D.
2. The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the chemical situation or process increases, and when workers are required to perform different tasks. Personnel should upgrade or downgrade their level of protection only with concurrence with the site supervisor, safety officer, or plant industrial hygienist.

3. The recommendations in Table VIII:1-1 serve only as guidelines. It is important for you to realize that selecting items by how they are designed or configured alone is not sufficient to ensure adequate protection. In other words, just having the right components to form an ensemble is not enough. The EPA levels of protection do not define what performance the selected clothing or equipment must offer. Many of these considerations are described in the "**limiting criteria**" column of Table VIII: 1-1. Additional factors relevant to the various clothing and equipment items are described in subsequent Paragraphs.

E. ENSEMBLE SELECTION FACTORS.
2. **Chemical Hazards**. Chemicals present a variety of hazards such as toxicity, corrosiveness, flammability, reactivity, and oxygen deficiency. Depending on the chemicals present, any combination of hazards may exist.

3. **Physical Environment**. Chemical exposure can happen anywhere: in industrial settings, on the highways, or in residential areas. It may occur either indoors or outdoors; the environment may be extremely hot, cold, or moderate; the exposure site may be relatively uncluttered or rugged, presenting a number of physical hazards; chemical handling activities may involve entering confined spaces, heavy lifting, climbing a ladder, or crawling on the ground. The choice of ensemble components must account for these conditions.

4. **Duration of Exposure**. The protective qualities of ensemble components may be limited to certain exposure levels (e.g. material chemical resistance, air supply). The decision for ensemble use time must be made assuming the worst case exposure so that safety margins can be applied to increase the protection available to the worker.

5. **Protective Clothing or Equipment Available**. Hopefully, an array of different clothing or equipment is available to workers to meet all intended applications. Reliance on one particular clothing or equipment item may severely limit a facility's ability to handle a broad range of chemical exposures. In its acquisition of equipment and clothing, the safety department or other responsible authority should attempt to provide a high degree of flexibility while choosing protective clothing and equipment that is easily integrated and provides protection against each conceivable hazard.

F. CLASSIFICATION OF PROTECTIVE CLOTHING.
Personal protective clothing includes the following:

- ✓ Fully encapsulating suits;
- ✓ Nonencapsulating suits;
- ✓ Gloves, boots, and hoods;
- ✓ Firefighter's protective clothing;
- ✓ Proximity, or approach clothing;
- ✓ Blast or fragmentation suits; and
- ✓ Radiation-protective suits.

1. Firefighter turnout clothing, proximity gear, blast suits, and radiation suits by themselves are not acceptable for providing adequate protection from hazardous chemicals.

2. Table VIII:1-2 describes various types of protection clothing available, details the type of protection they offer, and lists factors to consider in their selection and use.

TABLE VIII: 1-2. TYPES OF PROTECTIVE CLOTHING FOR FULL BODY PROTECTION

Description
Type of Protection
Use Considerations

Fully encapsulating suit

- ✓ One-piece garment. Boots and gloves may be integral, attached and replaceable, or separate.

- ✓ Protects against splashes, dust gases, and vapors.

- ✓ Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a closed-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.

Nonencapsulating suit

- ✓ Jacket, hood, pants or bib overalls, and one-piece coveralls.

- ✓ Protects against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.

- ✓ Do not use where gas-tight or pervasive splashing protection is required. May contribute to heat stress in wearer. Tape-seal connections between pant cuffs and boots and between gloves and sleeves.

Aprons, leggings, and sleeve protectors

- ✓ Fully sleeved and gloved apron. Separate coverings for arms and legs. Commonly worn over nonencapsulating suit.
- ✓ Provides additional splash protection of chest, forearms, and legs.

Whenever possible, should be used over a nonencapsulating suit to minimize potential heat stress. Useful for sampling, labeling, and analysis operations. Should be used only when there is a low probability of total body contact with contaminants.

Firefighters' protective clothing

Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973, and boots (1974).

Protects against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consists of an outer shell, an inner liner and a vapor barrier with a minimum water penetration of 25 lb/in2 (1.8 kg/cm2) to prevent passage of hot water.

Decontamination is difficult. Should not be worn in areas where protection against gases, vapors, chemical splashes or permeation is required.

Proximity garment (approach suit)

- ✓ One- or two-piece overgarment with boot covers, gloves, and hood of aluminized nylon or cotton fabric. Normally worn over other protective clothing, firefighters' bunker gear, or flame-retardant coveralls.
- ✓ Protects against splashes, dust, gases, and vapors.
- ✓ Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a closed-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.

Blast and fragmentation suit

- ✓ Blast and fragmentation vests and clothing, bomb blankets, and bomb carriers.
- ✓ Provides some protection against very small detonations. Bomb blankets and baskets can help redirect a blast.
- ✓ Does not provide for hearing protection.

Radiation-contamination protective suit

- ✓ Various types of protective clothing designed to prevent contamination of the body by radioactive particles.

- ✓ Protects against alpha and beta particles. Does not protect against gamma radiation.

- ✓ Designed to prevent skin contamination. If radiation is detected on site, consult an experienced radiation expert and evacuate personnel until the radiation hazard has been evaluated.

- ✓ **Flame/fire retardant coveralls.**
- ✓ Normally worn as an undergarment.

- ✓ Provides protection from flash fires.

- ✓ Adds bulk and may exacerbate heat stress problems and impair mobility

III.

F. CLASSIFICATION OF CHEMICAL PROTECTIVE CLOTHING. Table VIII:1-3 provides a listing of clothing classifications. Clothing can be classified by design, performance, and service life.

Checking a gas meter and make sure to document your readings.

Written Program Example Section

BEST AVAILABLE CONTROL TECHNOLOGY (BACT):
The best control technology that is available for each contaminant. This determination will be made by the Commissioner on a case-by-case basis taking into account energy, environmental, health risk, costs and economic impacts of alternative control systems.

HEALTH HAZARD: A chemical for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees.

The term "**health hazard**" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatoxins, nephrotoxins, neurotoxins, agents that can act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Written Hazard Communication Program
Example

This written program provides information specific to the implementation of the Town of Sunflower's Hazard Communication Program, in accordance with the Federal Hazard Communication Standard, Title 29 Code of Federal Regulation, Part 1910.1200, the Town of Sunflower's Hazard Communication Program Summary and the Uniform Fire Code(HMIS).

A copy of this workplace written program, including the Water Department Hazard Communication Program document (Attachment 1), Hazard Assessment Survey Data Sheet, (Atch 2). Hazardous Material Inventory Form (Atch 3), Hazardous Material Tracking Form, (Atch 4), List of the Non-Routine Tasks, involving hazardous materials (Atch 5), and Hazard Communication Program Evaluation Checklist, (Atch 6), will be maintained within the section by the Section Supervisor under the guidance of the Safety Manager (SM), is delegated the overall responsibility of managing the Town of Sunflower's Hazard Communication Program by the Town Manager

1. Employee Information and Training:

a. The Section Supervisor shall ensure employees are trained on Hazard Communication before they handle or are occupationally exposed to hazardous materials. Formal training is provided by the Town of Sunflower.
b. The Section Supervisor shall supplement this training to provide information on section job-specific chemical and physical hazards.
c. The Section Supervisor shall ensure that Hazard Communication training is documented.
d. The Section Supervisor may delegate the actual task of employee Hazard Communication training to the HCM(s); however, the overall responsibility for training rests with the supervisor.

2. Section Hazard Assessments:

a. Hazard assessments shall be used by either the Supervisor or the HCM as a training tool to brief employees on potential chemical and physical hazards within the section. See Hazard Communication Program Evaluation, (Atch 2).

b. When a new chemical and/or process is introduced into the section, the Supervisor shall ensure that the Safety Manager (SM) is consulted and a hazard assessment is generated for the Safety Manager's review and approval.

3. Safety Data Sheets (SDS (formerly MSDS)s):

a. The Safety Manager maintains the SDS (formerly MSDS) master file containing all hazardous chemicals used within each of the Divisions. The master file consists of Occupational Safety and Health Administration (OSHA) Form 174, "Safety Data Sheet," or equivalent forms will be readily available to all employees. Employees must be briefed on the location of the master file by the Section Supervisor or HCM.
b. Employees desiring specific SDS (formerly MSDS) information for chemical products used in their section will contact the Section Supervisor to establish a

mutually acceptable time during the current work shift for review of the SDS (formerly MSDS)(s). The Section Supervisor will review the SDS (formerly MSDS) with the employee and provide an explanation of the SDS (formerly MSDS) information. The Safety Manager (SM), or the HCM shall be contacted for SDS (formerly MSDS) assistance if either the Section Supervisor or employee lacks answers to SDS (formerly MSDS) questions.

c. The Section Supervisor shall ensure SDS (formerly MSDS)s are available for all chemical products used in the section, and that products are properly labeled. The HCM can assist in this task.

d. Section SDS (formerly MSDS)s shall be posted in the Master SDS (formerly MSDS) file by the Section Supervisor. SDS (formerly MSDS) copies are also required to be posted in the Section Safety Folder and used as a training tool.

4. Hazardous Material Inventory:

a. The hazardous material inventory for this section will be developed by the Section Supervisor and the HCM. The Safety Manager, Section Supervisor, and HCM, will review the inventory initially and annually.

b. The Section Supervisor can delegate the task of maintaining the Hazardous Material Inventory Form (Atch 3), and the Hazardous Material Tracking Form, (Atch 4), in the work area, to the HCM. However, the responsibility of maintaining a current listing of chemicals used in the section, rests with the Section Supervisor.

c. As a minimum, the inventory will include the identity of each hazardous chemical used in the work area, as it appears on the SDS (formerly MSDS); i.e. Nomenclature, Manufacturer, Unit of Issue, and disposal requirements, if any. Proprietary information will not be included on the hazardous chemical inventory.

d. When new chemicals are introduced into the work area, the Section Supervisor is responsible for ensuring the Safety Manager or HCM is consulted.

5. Non-Routine Tasks Involving Hazardous Materials:

a. Non-routine tasks are:

(1) Those tasks included within a work area's normal activities but performed infrequently; for example, cleaning up spills. The HCM or Safety Manager can assist in this task.

(2) Temporary duties outside an individual's normal job assignment.

b. The Section Supervisor has overall responsibility for documenting all non-routine tasks performed in the section. See the Non-Routine Task Example, (Atch 5).

(1) The supervisor will ensure that non-routine tasks, associated hazards, and controls are briefed before employees perform non-routine tasks.

(2) The supervisor will document hazard communication training provided to temporarily assigned employees, and forward a copy of the documentation to the worker's formal supervisor describing the training conducted.

6. **Program Quality Control**: The Safety Manager, Section Supervisor and HCM shall audit the Hazard Communication Program annually, using the Hazard Communication Program Evaluation Checklist, (Atch 6). The Safety Manager will report the findings and status of the program to the Town Manager and Section Safety Representatives at monthly T.O.S. Safety Committee meetings.

Hazard Communication Monitors

The Town Manager and the Safety Manager will select qualified technical personnel to assist in supporting the Hazard Communication Policy and the written evaluations. The HCM(s) will assist and perform routine health and safety audits and will perform training. These findings will be evaluated by the Town Manager and the Safety Manager. The primary safety responsibility will remain will the Section Supervisors.

Currently, the HCM(s) are _________________- and Your Name, and the Safety Manager.

6 Attachments

1. Hazard Assessment Survey Data Sheet

2. Hazardous Material Inventory Form

3. Hazardous Material Tracking Form

4. Non-Routine Task Example

5. Hazard Communication Program Evaluation Checklist

6. Hazard Communication Summary

These chemical containers where cited in a recent unannounced OSHA inspection. The flammable chemicals were not "**grounded and bonded**" and you will notice that the Inspector is asking several related and unrelated questions to this employee.

Hazard Communication Program Summary *Example*

PURPOSE: To ensure that the hazards of chemicals used by the Town of Sunflower are properly communicated to all Town of Sunflower employees. This provides regulatory compliance with the provisions of the OSHA Hazard Communication Standard 1910.1200. and the EPA Emergency Planning and Community Right-To- Understand standard.

SCOPE: This Town of Sunflower Hazard Communication Program applies to <u>all employees</u> of the Town of Sunflower. Pertinent information as to chemical hazards and the procedures for dealing with these hazards will be properly communicated to all persons entering a Town of Sunflower facility or any field work site.

- This includes contractors, vendors, and members of the public who come on to T.O.S. facilities.

Operational Requirements
INVENTORY

Each Department will set up procedures to ensure that:

I. A complete inventory of all chemicals at each facility is to be completed by April 2013.
II. Inventories will include the name of the chemical, the name of the manufacturer, storage container type and size and the minimum and maximum quality stored (for example, household bleach, Sunrise brand, industrial chemical container type, quart sized plastic bottle, (minimum 10, maximum 48).
III. New or deleted chemicals are to be posted to the inventory within five 5 working days and the minimum/maximum quantities are updated quarterly.

SDSs
Safety Data Sheets contain the chemical manufacturer's recommended procedures for treatment of injuries caused by exposure to the chemical and clean-up of any spills.

There must be an SDS (formerly MSDS) for each chemical listed on the inventory at each facility using the chemical. The Section Supervisor is responsible for obtaining an extra SDS (formerly MSDS) for both the Safety Manager and the Hazard Communication Monitor.

Each Department will have one or more files of SDS (formerly MSDS)s. The number and location of these files will be determined by accessibility by employees. The files shall not be located in a room or area that is not accessible by employees (for example, a room that is locked during normal business hours).

LABELING

i. An essential element to notify users of the hazard(s) of a chemical.
ii. The chemical manufacturer or importer is required to place a proper label on all original containers.
iii. If the manufacture's label has been defaced, a new label must be fabricated.
iv. The section supervisor will be responsible for ensuring that each chemical is properly labeled and that deficiencies are corrected.

If the chemical product has been decanted or poured from its original container to another container such as a spray bottle or pail, the bottle or pail must be properly labeled.

- The Hazardous Material Identification System (HMIS) is a method for consistently marking chemicals with a label, which denotes the level of the hazard. There are four sections to a label: Toxicity, Flammability, Reactivity, and Warnings. These signs and stickers are available from the Safety Manager.
- Each Section Supervisor will ensure that portable containers such as spray bottles or buckets are marked with both the name of the chemical and the appropriate HMIS label. The container from which the chemical was decanted must be properly labeled and also have a HMIS label with the same hazard markings.

TRAINING

The Town of Sunflower Safety Manager will ensure that all employees have been properly trained on the Hazard Communication program and the HMIS (Hazardous Material Identification System).

Hazardous Materials Policy Committee (HMPC)

The Town of Sunflower has established and will maintain a committee to provide policy and oversight for chemical safety.

The committee is made up of:

- The Town Manager
- Safety Manager
- A Section Supervisor/Delegate from each Department
- Fire/Technical resource personnel

If you require any assistance or have a question, please contact your Section Supervisor or Safety Manager.

DEPARTMENT SPECIFIC HAZARD COMMUNICATION PROGRAM *EXAMPLE*

This operating instruction provides specific policies, procedures and assigned responsibility to implement the Water Department's Hazard Communication Program. This is in accordance with OSHA Hazard Communication Standard 1910.1200, Town Administration Hazard Communication Regulation, and the Town of Sunflower's Hazard Communication Program Executive Summary.

PURPOSE: **The purpose of this operating instruction is to ensure that chemical and physical hazards are properly communicated to all Water Department (WD) personnel.**

SCOPE: This operating instruction applies to all assigned personnel at the Water Department.

POLICIES/PROCEDURES: Copies of the following documents will be kept readily available to all employees in each work area subject to this operating instruction. These documents must be placed in labeled notebooks, available to all employees.

(1) Town Personnel Rules and Regulations, State and Federal Rules and Fire Codes governing Hazardous Materials.

(2) Town of Sunflower's Hazard Communication Program Executive Summary.

(3) Town of Sunflower's Written Hazard Communication Program.

(4) Section's Written Hazard Assessments Evaluations Data Sheets.

(5) Section's Chemical Inventory Document.

(6) Safety Data Sheets (SDS (formerly MSDS)s) for each hazardous material.

(7) Non-Routine Hazard Assessments Evaluations Data Sheets.

(8) A Fire Evacuation/Egress plan.

(9) Copies of Town of Sunflower Safety Department surveys, sampling documentation, findings and recommendations, and/or outside consultative health and safety reports.

(a) A notice will be posted on the safety bulletin board stating the specific location of the above documents and the name of the Department's Safety Chairperson.

(b) Personnel will be given an opportunity to have SDS (formerly MSDS)s and Hazard Assessments explained by their Supervisor during their normal duty hours. If any questions concerning an SDS (formerly MSDS) or Hazard Assessments arise that neither the supervisor or the Department's Safety Chairperson can answer, contact the Administrative Services Director for assistance

(c) All personnel using hazardous materials or that perform hazardous job tasks will be trained by the Section Supervisor. The Supervisor can delegate this training to the Administrative Services Director. The Supervisor still retains the responsibility for Hazard Communication compliance in his or her section.

(d) Each WD employee will be trained by using the Town of Sunflower's Written Hazard Communication Program, associated attachments, and Water Hazard Communication Program documents to ensure standardization of training.

4. **RESPONSIBILITIES ASSIGNED:**

a. **WATER SUPERINTENDENT:**

(1) Responsible for the implementation of the Water Department Hazard Communication Program.

(2) Assigns the Safety Chairpersons and Alternates for the Town of Sunflower's Hazard Communication Compliance Committee/Safety Committee.

(3) Directs Section Supervisors to prepare a Written Hazard Assessment Evaluations which includes job-specific hazard communication training.

(4) Ensures that all WD supervisors and personnel are subject to this regulation.

(5) Ensures the Water Department complies with the Town of Sunflower "Hazardous Material Purchasing" guidance document.

(6) Directs the Hazard Communication Monitor to assist Section Supervisors in safety/environmental training.

b. **SAFETY CHAIRPERSON -** *With delegated authority from the Superintendent*:

(1) Provide program oversight and consultation for the implementation of the Department's Hazard Communication Program and the Safety Program.

(2) Be an active member on the Water Department's Hazard Communication Compliance Committee/Safety Committee and distribute all relevant materials with the assigned Alternate and all staff/personnel.

(3) Act as the Department's point of contact for any program coordination, and compliance issues, with OSHA, Town, and/or Water Department (WD) safety, health, or environmental compliance representatives.

(4) Conduct periodic audits on their Department's HazCom Program and report results to the Director or the Administrative Services Director.

(5) Review the Department's Master Safety Data Sheet Binder.

(6) Review an inventory of all hazardous chemicals used or stored at your Department. Provide the document to requesting agencies.

(7) Provide consultation upon request, to Section Supervisors whom are ordering chemical products that are not on the Hazard Materials Purchasing List.

c. SECTION SUPERVISORS: (Field Supervisor and Customer Service Supervisor)

(1) Responsible for ensuring assigned personnel receive "**job specific**" hazard communication training, prior to performing any tasks that requires the use of hazardous chemicals or hazardous job function. The Hazard Communication Monitor (**HCM**) and Departmental Safety Chairperson will be able to assist in this task.

(2) Responsible for ensuring all assigned personnel receive "**job specific**" hazard communication training, prior to performing any tasks that requires the use of hazardous chemicals or hazardous job function. The Hazard Communication Monitor (**HCM**) and Departmental Safety Chairperson will be able to assist in this task.

(3) Responsible for completing all Hazard Assessments for their sections. This will include: Chemical, physical and health related assessments, Fire Evacuation plans, Non-Routine Hazard Assessments, and Chemical inventories. The Hazardous Communication Monitor (**HCM**) and Departmental Safety Chairperson will be able to assist in this task.

(3) Inform the Water Department Safety Chairperson of any new or deleted processes where chemicals are or were involved and ensure an SDS (formerly MSDS) is provided for the new product(s).

(4) Generate a hazard assessment for each new or altered process where chemicals are used and ensure that personnel are aware of the hazards and required PPE for the new task. The HCM and Departmental Safety Chairperson can assist with this task.

(5) Assist the Safety Chairperson and the HCM during audits of the section program.

(6) Provide opportunities for personnel to review SDS (formerly MSDS)s and Hazard Assessment Evaluations and have them explained during the employee's normal shift

(7) Attend Supervisors' Hazard Communication Training and any relevant safety/environmental training.

(8) Ensure work area Non-Routine tasks, associated hazards and controls for the infrequent tasks performed in the work area, are documented and reviewed by the Administrative Services Director. The HCM can assist with this task.

(9) Provide personnel with proper personal protective equipment. Each work facility and vehicle shall have a First Aid Kit and a Fire Extinguisher.

(10) Supervisors will ensure a copy of each required SDS (formerly MSDS) in the workplace is maintained in a program binder and that the Administrative Services Director has a copy.

(11) SDS (formerly MSDS)'s will be in close approximation to the chemical(s) in use. Each WD vehicle will have applicable SDS (formerly MSDS)'s on board for each hazardous chemical product and an appropriate Spill Kit.

(12) Ensure that personnel interfacing with contractor operations that are using hazardous materials are given information on the use of hazardous materials and safety and health precautions. Should the section request the assistance of Contractor Personnel, the Section Supervisor shall provide the Contractor with SDS (formerly MSDS)'s and provide answers to the Contractor's questions pertaining to health and safety issues.

(13) Responsible for all safety and hazard related training documentation.

d. **HAZARD COMMUNICATION MONITOR (HCM):**

(1) Serve on the Town of Sunflower's Hazard Communication Compliance Committee and Safety Committee.

(2) Review the section's chemical inventory as assigned.

(3) Assist the Department's Safety Chairperson with program audits.

(4) Assist the Section Supervisor with complying with guidelines addressed in the Town's Hazardous Material Purchasing document when requesting chemical products.

e. **ASSIGNED PERSONNEL:**

(1) Understand and follow both the Hazard Communication Policy and Safety Program.

(2) Wear the required personal protective equipment (**PPE**) stated on hazard assessments.

(3) Work safely at all times and do not take shortcuts during processes involving chemicals.

(4) Inform the Section Supervisor, HCM, or your Department's Safety Chairperson of health/safety concerns related to chemical use or physical hazards.

(5) Inform your supervisor of any occupational injuries, illnesses or "**near misses**" involving chemicals or physical hazards.

(6) If you do not understand this document or have any safety-related questions, it is your responsibility to ask your supervisor for assistance.

EFFECTIVE DATE: This operating instruction shall be effective immediately.

Chemical Inventory Forms and Hazard Assessment Examples

CHEMICAL FAMILY: Describes the general nature of the chemical. Chemicals belonging to the same family often share certain physical and chemical properties and toxic effects.

However, there may also be important differences. For example, toluene and benzene both belong to the aromatic hydrocarbon family. However, benzene is a carcinogen, but toluene is not.

Hazard Certification

HAZARD ASSESSMENT SURVEY DATA SHEET	
DATE OF EVALUATION:	**DATE LAST EVALUATED**: N/A
DEPARTMENT	
DEPARTMENT:	**TELEPHONE:**
ADDRESS/LOCATION:	**NAME OF SECTION SUPERVISOR**:
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:**
POTENTIAL HAZARDS (Describe the Process) (Who, What, When, Where, How, Why) (Review SDS (formerly MSDS))	
EVALUATION (Your Findings/Discrepancies)	
CONTROLS (Existing or Recommended Protective Equipment, Engineering or Administrative Controls)	
Existing: **Recommended:**	
Surveyed By:	**Reviewed By:**

HAZARD ASSESSMENT SURVEY DATA SHEET

DATE OF EVALUATION:	**DATE LAST EVALUATED**: N/A
DEPARTMENT:	**TELEPHONE:**
ADDRESS/LOCATION:	**NAME OF SECTION SUPERVISOR**:
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:**

NON-ROUTINE POTENTIAL HAZARDS
(Describe the Process) (Who, What, When, Where, How, Why) (Review SDS (formerly MSDS))

EVALUATION
(Your Findings/Discrepancies)

CONTROLS
(Existing or Recommended Protective Equipment, Engineering or Administrative Controls)

Existing:

Recommended:

Surveyed By:	**Reviewed By:**

HAZARD ASSESSMENT SURVEY DATA SHEET *Example*

DATE OF EVALUATION: October 25, 1999	**DATE LAST EVALUATED**: N/A

TOWN OF SUNFLOWER, PUBLIC WORKS DEPARTMENT

DEPARTMENT: Water Department / Water Quality	**TELEPHONE:** 474-5242 Ext. 289
ADDRESS/LOCATION: 303A N. Beeline Hwy Various well sites and field locations	**NAME OF SECTION SUPERVISOR**: Buzz Binder
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:** Your Name

POTENTIAL HAZARDS

(Describe the Process) (Who, What, When, Where, How, Why) (Review SDS (formerly MSDS))

Water Sampling/Acid Preservation: Water Quality personnel will collect and preserve samples with acid on special events and during emergency incidents. Water Quality personnel will preserve samples with acid on routine, special and during emergency events in the field, in sampling vehicles, at the treatment facilities and in the bottle–prep area of the office. Personnel should avoid using concentrated acid, the usual strength is diluted to1:1. Acid use per sample varies (two drops up to five mils. per sampling event). The most common acids used by the Water Quality section are: Nitric (HNO_3) Hydrochloric (HCL), Ascorbic ($C_6H_8O_6$), Sulfuric (H_2SO_4) and Ammonium Chloride (NH_4Cl).

Exposure to corrosive materials can cause several types of injuries, both acute and chronic. Primary injuries include :

1. Direct exposure to skin, causing irritation or redness of the skin. Skin tissue may be charred or destroyed in severe cases.
2. Exposure to eyes could cause loss of sight. The eyes should be flushed with water immediately for 15 minutes and medical attention obtained as soon as possible.
3. Exposure to the respiratory tract through inhalation will cause serious coughing attacks. Injury to the mucous membranes of the nose, throat, and alveolar (air sacks) membranes of the lungs can occur.

The standard rule for preservation with acid should be as follows: **ADD ACID TO WATER**. Adding water to acid will cause splashing which will increase the possibilities of exposure and injury. The Water Quality section also collects samples in pre-preserved sample bottles, which contain acid. These types of sample bottles must be collected with the highest degree of safety care because water is being added to the acid. Tilting the bottles away from personnel and reducing the water flow will help lessen the chance of exposure.

EVALUATION

(Your Findings/Discrepancies)

To Date: Water Quality personnel have not experienced any reported injuries as a result of using the various acids during sample preservation. Personnel have been educated in the various potential hazards associated with the above mentioned acids. Personnel have read and understand the SDS (formerly MSDS) information provided by the manufacturer. They have received video/verbal training on the subject. Water Quality personnel are aware of the fact, that collecting samples in pre-preserved bottles accelerate the potential of exposure. Personnel Protective Equipment (PPE) is readily available to all employees. Common sense and safe sampling/acid use techniques are routinely stressed and monitored by management and the Safety Manager. All Water Quality personnel are aware of minor spills contain/cleanup procedures, as well as personal decontamination measures.

SPILL RESPONSE and CLEAN UP PROCEDURES: Immediately alert others in the area and the supervisor, and evacuate the area if spill exceeds cleanup capabilities of the section. Personnel involved in the cleanup must use appropriate personal protective equipment, absorbent spill material and other safety' clean-up items as needed (refer to the Safety Data Sheet and NIOSH pocket guide for information). If a volatile, flammable material is also spilled, control sources of ignition and ventilate the area. Protect floor drains or other means of environmental release, with Spill socks, absorbent materials and etc. as needed. Distribute loose spill control material over the entire area, working from the outside, and circling to the center. This reduces the chance of splash or spreading of the spilled chemical. When the spilled materials have been absorbed, use a brush and a scoop to place materials in an appropriate container.

1 of 2 pages

CONTROLS

(Existing or Recommended Protective Equipment, Engineering or Administrative Controls)

Existing Controls:
PPE: Acid resistant aprons, gloves and unvented goggles.
Engineering: Emergency eyewash in First Aid Kits.
Administrative: Spill Kits, Good housekeeping procedures, warning signs, and signs posted for locations of spill and first aid kits. All stored acid must be clearly labeled as a corrosive substance and stored away from any Bases (Caustic materials). The storage location for the Acid must be posted with "Warning Acid" signs to alert employees to the potential hazards of the chemical.
Recommended: Continued safety and acid handling training and periodic review.

2 of 2 pages

Surveyed By: Your Name	**Reviewed By:** Jack Fields

HAZARD ASSESSMENT SURVEY DATA SHEET

DATE OF EVALUATION: July 26, 2002	**DATE LAST EVALUATED**: N/A

TOWN OF SUNFLOWER, PUBLIC WORKS DEPARTMENT

DEPARTMENT: Parks and Recreation	**TELEPHONE:** 474-5242 Ext. 306
ADDRESS/LOCATION: 700 N. McLane Rd, Various field locations	**NAME OF SECTION SUPERVISOR**: Nelson Beck
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:** Your Name

POTENTIAL HAZARDS

(Describe the Process) (Who, What, When, Where, How, Why) (Review SDS (formerly MSDS))

CHAINSAW: Parks personnel will work on a variety of vegetation with all types of pruning tools including chainsaws. Using chainsaw and its obvious hazards are a growing concern for this Department. Physical conditions, knots, unseen branches, unusual vegetation growth, inclimate weather, heat, slippery surfaces, and reaching add to the increased potential for chainsaw mishaps and physical injury. The Section Supervisor will provide personal protective equipment, gloves, faceshield, chaps, ear plug or muffs, reflective safety vests, hard-hats and training to work in tree trimming areas.

EVALUATION

(Your Findings/Discrepancies)

All Parks Personnel have personal protective equipment, gloves, faceshield, chaps, ear plug or muffs, reflective safety vests, hard-hats and training to work in tree trimming areas available to lessen the degree of hazard potential. All Parks personnel have received training in arbor methods. All personnel have been educated in potential hazards, personnel are reminded to be aware of their surrounding area during construction or work on streets or around traffic.

CONTROLS

(Existing or Recommended Protective Equipment, Engineering or Administrative Controls)

Existing: Personal protective equipment, gloves, faceshield, chaps, ear plug or muffs, reflective safety vests, hard-hats and training to work in tree trimming areas available to lessen the degree of hazard potential.

Recommended: More safety instruction classes and annual refresher tool safety videos. All Employees who are required to use PPE shall be trained to know at least the following:

6) When PPE is necessary;
7) What PPE is necessary;
8) How to properly don, remove, adjust, and wear PPE;
9) The limitations of the PPE
10) The proper care, maintenance, useful life and disposal of the PPE.

Each affected Employee shall demonstrate an understanding of the training and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.

Outsourcing major tree trimming to independent contactor.

Surveyed By:	**Reviewed By:**

HAZARD ASSESSMENT SURVEY DATA SHEET *Example*

DATE OF EVALUATION: October 15, 1999	**DATE LAST EVALUATED**: N/A

TOWN OF SUNFLOWER, PUBLIC WORKS DEPARTMENT

DEPARTMENT: Water Department / Water Distribution	**TELEPHONE:** 474-5242 Ext. 305
ADDRESS/LOCATION: 700 N. McLane Rd, Various field locations	**NAME OF SECTION SUPERVISOR**: Marc Shewey
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:** Your Name

POTENTIAL HAZARDS

(Describe the Process) (Who, What, When, Where, How, Why) (Review SDS (formerly MSDS))

TRAFFIC / BARRICADING: Water Distribution personnel will work on a variety of streets, dealing with all types of traffic. Town traffic and its obvious hazards are a growing concern for this Department. Tense driving conditions, aggressive and /or inattentive drivers, inclimate weather, add to the increased potential for traffic mishaps and physical injury. The Section Supervisor will provide barricading equipment, cones, reflective tape, reflective safety vests, hard-hats and training to work in streets/traffic areas. The assigned Competent Person will make the determination of what safety/barricading equipment will be needed at each job site. This information will be detailed on the Competent Person Job Report. This report will be reviewed by the Supervisor and kept on file for 5 years.

The Competent Person will contact the Dispatcher for all major street closures and sidewalk closures.

EVALUATION

(Your Findings/Discrepancies)

All Water Distribution Personnel have reflective safety vests, hard hats, reflective cones and barricades available to lessen the degree of hazard potential. All have received barricading training and have watched "Defensive Driving" safety videos. All personnel have been educated in potential hazards, received written guidance (See Attached) and watch an annual Traffic Safety video. Personnel are reminded to be aware of their surrounding area during construction or work on streets or around traffic.

If a major street or Highway needs barricades, or signage, (Street Closed) the contractor is called to set up the barricades and when work is completed, Water Distribution personnel will remove barricades from the street and will pick the barricades up.

CONTROLS

(Existing or Recommended Protective Equipment, Engineering or Administrative Controls)

Existing: Hard-hats, Traffic Cones, Reflective Safety Vests, and Lights on Vehicles.

Recommended: Personnel know to call for more barricading or how to ask for assistance to reduce hazards.

Surveyed By:	**Reviewed By:**

FIRE EVACUATION PLAN *Example*

DATE OF EVALUATION: February 15, 1999	**DATE LAST EVALUATED**: N/A

TOWN OF SUNFLOWER, PUBLIC WORKS DEPARTMENT

DEPARTMENT: Water Department	**TELEPHONE:** 474-5242 Ext 289
ADDRESS/LOCATION: 303A N. Beeline Hwy	**NAME OF DEPARTMENT SUPERINTENDENT:** Buzz Binder
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.138 -146 and Town of Sunflower	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:** Your Name

POTENTIAL HAZARDS

<u>FIRE</u>

FIRE: If smoke or fire is detected, remove any person that shall require assistance from immediate danger. Close doors to confine and to prevent the fire from spreading to other areas. Send for help. Call Sunflower Fire Department or **911**, any employee can call the Fire Department, or pull Fire Alarm.

Combat small, contained fires with portable fire extinguishers- **IF SAFE TO DO SO!** Exit building, with the last person to leave to close the door.

All personnel will evacuate to the north parking lot Assembly Area (North of City Hall).

Management shall authorize any occupant to sound the alarm and notify the Fire Department upon the discovery of fire or smoke.

CONTROLS

(Existing or Recommended Protective Equipment, Engineering or Administrative Controls)

Every Department/Building/Section in the Town of Sunflower is required by 29 CFR 1910.38 and the Town Fire Safety Program to include evacuation procedures, rules for fire extinguishers, fire suppression, and building fire exit inspections. Exercising the plan with Fire Department input and cooperation is essential, especially the scheduling of periodic fire exit drills. It is your Section Supervisor's responsibility to develop a fire evacuation plan and to conduct fire exit drills.

The purpose of fire exit drills is to ensure a safe and orderly exit from the building. In the event of a fire, speed is secondary to proper order and control. An initial fire drill shall be held on approval of this plan by the Fire Department. Additional drills will be held every (6) six months. The Fire Department will assist and participate in the first scheduled fire exit drill and will assist the Section Supervisor in preparing a fire inspection and plan of action for fire evacuation drills.

Portable fire extinguishers are provided throughout the Water Dept. building for extinguishing small controllable fires. Fire extinguisher use training is available. All employees must be familiar with the fire evacuation plan, exits, and assigned refuge area (North Parking Lot)

Management shall insure that building fire protection and emergency equipment is maintained. Management shall maintain a list of all disabled personnel known to be occupants of the building. The Safety Representative will insure that Safety Data Sheets and the Chemical Inventory are made available to the Fire Department for emergency use.

Surveyed By: Your Name	**Reviewed By:** Jack Fields

FIRE EVACUATION/EGRESS PLAN

DATE OF EVALUATION:	DATE LAST EVALUATED:
DEPARTMENT:	
DEPARTMENT:	**TELEPHONE:**
ADDRESS/LOCATION:	**NAME OF DEPARTMENT DIRECTOR:**
Actions are required by: 29 CFR 1910.1200, 29 CFR 1910.138 -146 and Uniform Fire Code	**NAME OF HAZARD COMMUNICATION PROGRAM MONITOR:**
FIRE	
CONTROLS (Existing or Recommended Protective Equipment, Engineering or Administrative Controls)	
Surveyed By:	**Reviewed By:**

DEPARTMENT:SECTION:

HAZARDOUS MATERIALS INVENTORY FORM
DATE:

LOCATION:		INVENTORIED BY:	

TRADE OR COMMON NAME	MANUFACTURER	QUANTITY USED	DISPOSAL METHODS	SDS (formerly MSDS)	LABEL

Common Hazard Communication Acronyms

AAHAM	American Association of Healthcare Administrative Management
AAMVA	American Association of Motor Vehicle Administrator
AAPRO	American Association of Preferred Provider Organizations
ABI	Automated Broker Interface
ACER	Annual Contractor Evaluation Report
ACH	Automated Clearing House
ACORD	Agency-Company Organization for Research and Development
ACPE	American Council on Pharmaceutical Education
ACPS	Advanced Claims Processing System
ACR	American College of Radiology
ACR/NEMA	ACR/National Electrical Manufacturers Association
ACS	American College of Surgeons
ADA	American Dental Association
ADMD	Administration Management Domain
ADP	Automated Data Processing
ADR	Alternate Dispute Resolution
AEVCS	Automated Eligibility Verification Claims Submission
AFEHCT	Association for Electronic Health Care Transactions
AFT	Automated Funds Transfer
AGPA	American Group Practice Association
AGPAM	American Guild of Patient Account Managers
AHA	American Hospital Association
AHCPR	Agency for Health Care Policy and Research
AHIMA	American Health Information Management Association
AHP	Accountable Health Plan
AIAG	Automobile Industry Action Group
AIPSO	Auto Insurance Plans Service Office
AISO	Auto Insurance Services Group
AMA	American Medical Association
AMCR	Association for Managed Care Review
AMCRA	American Managed Care and Review Association
AMP	Automated Medical Payment
AMRA	American Medical Records Association
ANA	Article Numbering Association
ANSI	American National Standards Institute
AOA	American Osteopathic Association
APG	Ambulatory Patient Groups
API	Applications Program Interface
ARPA	Advanced Research Projects Agency
ARU	Audio Response Unit
ASAP	American Society for Automation in Pharmacy also, Analytic Systems Automated Purchasing
ASC	Accredited Standards Committees also, Ambulatory Surgical Center
ASCII	American Standard Code for Information Interchange
ASHMM	American Society for Hospital Materials Managers
ASN	Advanced Shipment Notice
ASTM	American Society of Testing Materials
ATA	Airline Transportation Association
ATG	Alignment Task Group

ATM	Asynchronous Transfer Mode also, Automated Teller Machine
BCBSA	Blue Cross and Blue Shield Association
BPS	Bits Per Second
BRMA	Brokers and Reinsurance Markets Association
BSC	Binary Synchronous Communications
BSR	Board of Standards Review also, Basic Semantic Repository
CALS	Computer Aided Acquisition and Logistics System
CAPA	Certified Aftermarket Parts Association
CAT	Catastrophic Claims
CBCP	Common Business Communications Protocol
IQCD	Cash Concentration and Disbursement
CCITT	Consultative Committee for International Telegraph and Telephone
CES	Clearinghouse Enforceability Services
CFR	Code of Federal Regulations
CHANDUS	Civilian Health and Medical Program of the Uniformed Services
CHAPS	Clearing House Automated Payments System
CHIPS	Clearing House Interbank Payments System
CHMIS	Community Health Management Information Systems
CHIN	Community Health Information Network
CHIPAS	Community Health Purchasing Alliance
CHN	Cooperative Healthcare Networks
CIAO	Construction Industry Action Group
CIDX	Chemical Industry Data Exchange
CIECA	Collision Industry Electronic Commerce Association
CII	Center for Informatization of Industry
CISG	Convention on the International Sale of Goods
CIU	Claims Investigative Unit
CLASS	Claims Acquisition and Submission System
CLIA	Clinical Laboratory Improvement Amendment
CMA	Cash Management Association
CMP	Comprehensive Medical Plans
COB	Coordination of Benefits
COS	Corporation for Open Systems
CPA	Canadian Payments Association also Canadian Petroleum Association
CPR	Computer-based Patient Record also, Comparative Performance Reports
CPRI	Computer-based Patient Records Institute, Inc.
CPS	Characters Per Second
CPT	Current Procedural Terminology
CQAS	Carrier Quality Assurance System
CR	Change Request
CRS	Commercially Reasonable Security
CSA	Canadian Standards Association
CSI	Customer Satisfaction Index
CTP	Corporate Trade Payment
CTX	Corporate Trade Exchange
CUIG	Credit Union Interchange Group
CV	Code Value
CWF	Common Working File
DCN	Document Control Number
DDT	Data Device Integration
DE	Data Element

DEA	Drug Enforcement Agency
DES	Data Encryption standard
DEX/UCS	Direct Exchange UCS
DFI	Depository Financial Institution
DISA	Data Interchange Standards Association, Inc.
DISH	Data Interchange for Shipping
DLTG	Delegate Liaison Task Group
DM	Data Maintenance
DIWERC	Durable Medical Equipment Regional Carriers
DMTF	Desktop Management Task Force
DMV	Department of Motor Vehicles
DOB	Date of Birth
DOD	Department of Defense
DOE	Direct Order Entry
DRP	Distribution Requirements Planning also, Direct Repair Program
DSD	Direct Store Delivery
DSTU	Draft Standard for Trial Use
DTTU	Draft Transaction for Trial Use
DUR	Drug Use/Utilization Reviews
DVR	Data Validation Reviews
EACH	Essential Access Community Hospital
EBCDIC	Extended Binary Coded Decimal Interchange Code
EC	Electronic Commerce also, European Community
ECE	Economic Commission of Europe
ECF	Extended Care Facility
ECR	Efficient Consumer Response
EDCD	UN/EDIFACT Composite Data Elements Directory
EDCL	UN/EDIFACT Code Lists
EDED	UN/EDIFACT Data Elements Directory
EDI	Electronic Data Interchange
EDIA	Electronic Data Interchange Association
EDICA	Electronic Data Interchange Council of Australia
EDEPACT	Electronic Data Interchange for Administration, Commerce and Transportation
EDIFICE	Electronic Data Interchange Forum for Companies Interested in Computing and Electronics
EDIM	Electronic Data Interchange Message
EDIX	Electronics Industry Data Exchange
EDM	Electronic Document Management
EDMD	UN/EDIFACT Standard Message Types Directory
EDSD	UN/EDIFACT Standard Data Segments Directory
EDPAF	Electronic Data Processing Auditors Foundation
EDS	Electronic Data Systems
EDX	Electronic Data Exchange
EEC	European Economic Community
EFT	Electronic Funds Transfer
EHNAC	Electronic Healthcare Network Accreditation Commission
EIAJ	Electronic Industry Association of Japan
EIDX	Electronic Industry Data Exchange
EIN	Employer Identification Number
EIS	Executive Information System

Email	Electronic Mail
EMC	Electronic Media Claims
EOB	Explanation of Benefits
EOQ	Economic Order Quantity
EPA	Environmental Protection Agency
EPP	EDEFACT Project Proposal
EPSDT	Early Periodic Screening Diagnostic Testing
ERA	Electronic Remittance Advise
ERISA	Employee Retirement Security Income Act
ERM	Electronic Record Management
ERS	Evaluated Receipts Settlement
ESDE	Environmental Safety Data Exchange
ESG	EDIFACT Steering Group
ESRD	End Stage Renal Dialysis
FA	Functional Acknowledgment
FACP	Final Administrative Cost Proposal
FAHS	Federation of American Health System
FARs	Federal Acquisition Regulations
FASB	Financial Accounting Standards Board
FCPA	Foreign Corrupt Practices Act
FDDI	Fiber Distribution Data Interface
FDO	Free Determining Official
FPS	Federal Information Processing Standard
FMC	Federal Maritime Commission
FN	Forward Notification
FOIA	Freedom of Information Act
FQHC	Federally Qualified Health Center
FTAM	File Transfer, Access and Management
FTP	File Transfer Protocol
FTS	Federal Telecommunications System
GAAP	Generally Accepted Accounting Principles
GAAS	Generally Accepted Auditing Standards
GAO	General Accounting Office
GHAA	Group Health Association of America
GOSIP	Government Open Systems Interconnection Profile
GSA	General Services Administration
GUS	Geographic Underwriting System
HCAD	Health Care Administrators
HCFA	Health Care Financing Administration
HCIN	Healthcare Information Network
HCPCS	HCFA Common Procedure Coding System
HCPR	Health Care Provider Records
HCRIS	Hospital Cost Report Information System
HCUP-3	Healthcare Cost and Utilization Project, 1988 - 1994
HDC	HCFA Data Center
HEDIC	Health Electronic Data Interchange Corporation
HEDIS	Health Plan and Employer Data and Information Set
HEDITP	Healthcare Electronic Data Interchange Trading Partner
HFMA	Healthcare Financial Management Association
HHS	Department of Health and Human Services
HIAA	Health Insurance Association of America

HIBCC	Health Industry Business Communications Council
HIDA	Health Industry Distributors Association
HIE	Health Insurance Enrollment
HIMA	Health Industry Manufacturers Association
HIMR	Health Insurance Master Record
HIMSS	Health Information and Management Systems Society
HIN	Health Industry Number
HIPC	Health Insurance Purchasing Cooperative
HIS	Hospital Information System
HISPP	Health Informatics System Planning Panel
HL7	Health Level 7
HMO	Health Maintenance Organization
HPSA	Healthcare Professional Shortage Area
IA	Interchange Agreement
IAG	Industry Action Group
IAIABC	International Association of Industrial Accident Boards and Commissions
IATA	International Airline Transport Association
ICC	international Chamber of Commerce
ICD-9	International Classification of Diseases, 9th Revision
ICED	Index of Co-Existent Disease
ICF	Intermediate Care Facility
ICN	Internal Control Number
ICOPS	Industry Committee for Office Products Standard
IDEA	International Data Exchange Association
IDMA	Insurance Data Management Association
IEC	International Electrotechnical Committee
IEDI	International Electronic Data Interchange
IEEE	Institute of Electrical and Electronic Engineers
IES	Inter-Enterprise System Clearing House
IETF	Internet Engineering Task Force
IFTM	International Forwarding and Transport Framework
IGP	Individual Group Practice
IHCEBI	Interactive Health Care Eligibility Benefits Inquiry
IHCEBR	Interactive Health Care Eligibility Benefits Response
III	Insurance Information Institute
IMG	International Medical Graduates
INS	International Network Services
IP	Internet Protocol
IPMS	Interpersonal Messaging Services
IPT	International Project Team
IRC	International Record Carrier
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISSB	Information Systems Standards Board
ISV	Independent Software Vendors
ITS	Inter-Plan Teleprocessing System
IV	Initialization Vector
IVANS	Insurance Value Added Network Service
IXRDA	Independent X-Ray Dealers Association
JAD	Joint Application Development
JCAHO	Joint Commission on the Accreditation of Health Organizations

JEDI	Joint Electronic Data Interchange
JIT	Just In Time
JRT	Joint Rapporteur Team
JTC I	Joint Technical Committee I
JTCIEDI	Joint Technical Committee for EDI
LAN	Local Area Network
LATA	Local Area and Transport Area
LIMNET	London Insurance Market Network
LIMRA	Life Insurance Marketing and Research Association
LOI	Letter of Intent
LRC	Longitudinal Redundancy Check
MAAC	Maximum Allowable Actual Charge
MAC	Message Authentication Code also, Maximum Allowable Cost
MAF	Medical Assisted Facility
MBA	Mortgage Bankers Association
MCO	Managed Care Organization
MDD	Maximum Daily Dose
MDG	Message Design Guidelines Group
MDN	Managed Data Networks
MEWA	Multiple Employer Welfare Arrangements
MGMA	Medical Group Management Association
MHS	Message Handling System
MMIS	Materials Management Information System
MNP	Microcom Network Protocol
MOMA	Message-Oriented Middleware Association
MOU	Memo of Understanding
MPI	Medicare Provider Identifier
MPIES	Medicare Physician Identification and Eligibility System
MS	Message Stores
SDS (formerly MSDS)	Materials Safety Data Sheets also, Message Standards Development Subcommittee
MTA	Message Transfer Agent
MTS	Medicare Transaction System
NABP	National Association of Boards of Pharmacy
NACHA	National Automated Clearing House Association
NACM	National Association of Credit Managers
NAEB	North American EDIFACT Board
NAGS	National Auto Glass Specifications, Inc,
NAHDO	National Association of Health Data Organizations
NAIC	National Association of Insurance Commissioners
NAII	National Association of Independent insurers
NAK	Negative Acknowledgement
NAMES	National Association of Medical Equipment Suppliers
NAAGC	National Association of Mutual Insurance Companies
NARA	National Archives and Records Administration
NATB	National Auto Theft, Bureau (now called NICB)
NBS	National Bureau of Standards
NCCI	National Council of Compensation Insurance
NCHS	National Center for Health Statistics
NCOIL	National Conference of Insurance Log4lators
NCP	Network Control Program

NCPDP	National Council for Prescription Drug Programs
NCQA	National Committee for Quality Assurance
NCSL	National Computer Standards Laboratory
NCVHS	National Committee for Vital & Health Statistics
NDM	Network Data Mover
NEIC	National Electronic Information Corporation
NEX/UCS	Network Exchange UCS
NHCAA	National Health Care Anti-Fraud Association
NICB	National Insurance Crime Bureau
NIST	National Institute for Standards of Technology
NMR	New Message Request
NMVTIS	National Motor Vehicle Title Information System
NN	Negative Notification
NOPA	National Office Products Association
NPF	National Provider File
NPI	National Provider Identifier
NSA	National Security Agency
NSC	National Supplier Clearinghouse
NSF	National Standard Format
NTFHR	National Task Force on Healthcare Reform
NUBC	National Uniform Billing Committee
NWC	National Workers Compensation Reinsurance Pool
NWDA	National Wholesale Druggists Association
O&P	Organization and Procedures
OBRA	Omnibus Budget Reconciliation Act
OCE	Open Collaborative Environment
OCHAMPUS	Office of Civilian Health and Medical Program of the Uniformed Services
OCR	Optical Character Recognition
ODETTE	Organization for Data Exchange Through Teletransmission
OFTP	ODETTE File Transfer Protocol
OIG	Office of Inspector General
OLTP	On-Line Transaction Processing
OM	Outcome Measurement
OMB	Office of Management and Budget
OMC	Office of Managed Care
OMG	Object Management Group
OPM	Organization and Procedure Manual
OPOP	Office of Provider Operations and Procedures
OSCAR	Online Survey and Certification and Reporting System
OSI	Open Systems Interconnection
OTP	Originating Trading Partner
P&C	Property and Casualty
PAD	Packet Assembler/Dissembler
PAEB	Pan American EDIFACT Board
PBM	Pharmacy Benefit Managers
PCS	Property Claims Services
PDAU	Physical Delivery Access Unit
PEB	Provider Electronic Billing
Pedi	Protocol for EDI
PIDX	Petroleum Industry Data Exchange
PIN	Personal Identification Number

PIP	Personal Injury Protection also, Periodic Interim Payment
PMA	Pharmaceutical Manufacturers Association
PMS	Practice Management System
PN	Positive Notification
POS	Point of Sale also, Point of Service
PP	Project Proposal
PPO	Preferred Provider Organization
PPSN	Public Packet Switched Network
PRB	Procedures Review Board
PS&R	Provider Statistics and Reporting System
PSTN	Public Switched Telephone Network
PTT	Post Telephone Telegraph Administration
QAP	Quality Assurance Program
QR	Quick Response
RA	Remittance Advice
RAA	Reinsurance Association of America
RBRVS	Resource Based Relative Value Scale
RDES	Regional Data Exchange System
RHHI	Regional Home Health Intermediary
RIMS	Reconsideration Information System
RINET	Reinsurance and Insurance Network
ROM	Regional Office Manual also, Read-Only Memory
RPCH	Rural Primary Care Hospital
RRC	Rural Referral Center
RT	Rapporteur's Advisory and Support Team
RTP	Receiving Trading Partner
RUG	Resource Utilization Group
SCC-JTC/EDI	Standards Council of Canada Joint Technical Committee on EDI
SCM	Shipping Container Marking
SDG	Syntax Development Group
SDLC	Synchronous Data Link Communication
SDO	Standards Developing Organization
SDS	Switched Digital Service.
SITA	Systeme Internationale Transport Aeronautique
SIU	Special Investigative Unit
SLA	Service Level Agreement
SMA	State Medicaid Agencies
SMDS	Switched Multimegabit Data Services
SNA	System Network Architecture
SNI	SNA Network Interconnect
SNADS	System Network Architecture Distribution Service
SNW	Simple Network Management Protocol
SONET	Synchronous Optical Network
SPBA	Society of Professional Benefit Administrators
SPIN	Standard Prescriber Identification Number
SPTG	Special Task Group
SPWG	Special Work Group
SSN	Social Security Number
SWIFT	Society for Worldwide Interbank Financial Telecommunications
T3POS	Transaction Processing Protocol for Point of Sale
TA	Technical Assessment

TAG	Technical Advisory Group also, Technical Assessment Groups
TCIF	Telecommunication Industry Forum
TCP/IP	Transmission Control Protocol Internet Protocol
TCP/IP FTP	Transmission Control Protocol/Internet Protocol - File Transfer Protocol
TCS	Trusted Computer System
TDCC	Transportation Data Coordinating Committee
TDF	Transborder Data Flow
TDI	Trade Data Interchange Also, Trading Data Interchange
TDI-AP	Trade Data Interchange - Applications Protocol
TEDIS	Trade Electronic Data Interchange Systems
TG	Task Group
TICD UN/	Draft Interactive Composite Data Elements Directory for UN/EDIFACT
TIMD UN/	Draft Interactive Messages Directory for UN/EDIFACT
TIN	Tax Identification Number
TP	Trading Partner
TPA	Third Party Administrators also, Trading Partner Agreement
TPSP	Third Party Service Provider
TR	Technical Report
TRACS	Trauma Registry of the American College of Surgeons
TDED	UN/EDIFACT Trade Data Element Directory
TS	Transaction Set
TSTS	Transaction Switching and Transport Service
UA	User Agent
UCC	Uniform Code Council
UCFTF	Uniform Claim Form Task Force
UCR	Usual, Customary, and Reasonable
UCS	Uniform Communications Standard
UN/ECE	United Nations Economic Commission for Europe
UN/EDIFACT	United Nations Electronic Data Interchange for Administration, Commerce, and Trade
UN/GTDI	UN/EDIFACT Guidelines for Trade Data Interchange
UN/ISO	United Nations International Standards Organization
UNCID	Uniform Rules of Conduct for Interchange of Trade Data by Teletransmission
UNID	Unique National Identifier
UNJEDI	United Nations Joint Electronic Data Interchange
UNSIM	UNEFACT Standard Interactive Message
UNSM	United Nations Standard Message
UNTDED	United Nations Trade Data Elements Directory
UNTDID	United Nations Trade Data Interchange Directory
UPC	Uniform Product Code
UPIN	Unique Physician Identification Number
UPC	Uniform Product Code
UPS	Uninterruptible Power Supply
URAC	Utilization Review Accreditation Commission
URO	Utilization Review Organization
USNC	United States National Committee
VAB	Value Added Bank
VAD	Value Added Distributor
VAN	Value Added Network
VAR	Value Added Reseller

VICS	Voluntary Industry Communications Standard
VIVM	Vendor Independent Messaging Interface
WWW	World Wide Web
WEDI	Work Group for Electronic Data Interchange
WG	Work Group
WNS	Warehouse Information Network Standard
X12C	Communications and Controls
X12E	Product Data
X12F	Finance
X12G	Government
X12H	Materials Management
X12I	Transportation
X12J	Technical Assessment
X12K	Purchasing
X12L	Industry Standards Transition
X12M	Distribution and Warehousing
X12N	Insurance

THRESHOLD LIMIT VALUES (TLV's): Expresses the airborne concentration of a material to which nearly all persons can be exposed, day after day, without adverse effects. TLV's are expressed three ways:
1. TLV-TWA: The allowable Time Weighted Average concentration for a normal 8-hour workday (40-hour work week).
2. TLV-STEL: The short-term exposure limit or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods per day, with at least 60 minutes between exposure periods) and provided the TLV-TWA is not exceeded.
3. TLV-C: The ceiling exposure limit is the concentration that should never be exceeded, even instantaneously.

States with Approved Plans

Commissioner
Alaska Department of Labor
1111 West 8th Street Room 306
Juneau, AK 99801
(907) 465-2700

Director
Industrial Commission of Arizona
800 W. Washington
Phoenix, AZ 85007
(602) 542-5795

Director
California Department of Industrial Relations
45 Fremont Street
San Francisco, CA 94105
(415) 972-8835

Commissioner
Connecticut Department of Labor
200 Folly Brook Boulevard
Wethersfield, CT 06109
(860) 566-5123

Director
Hawaii Department of Labor and Industrial Relations
830 Punchbowl Street
Honolulu, HI 96813
(808) 586-8844

Commissioner
Indiana Department of Labor
State Office Building
402 West Washington Street Room W195
Indianapolis, IN 46204
(317) 232-2378

Commissioner
Iowa Division of Labor Services
1000 E. Grand Avenue
Des Moines, IA 50319
(515) 281-3447

Secretary
Kentucky Labor Cabinet
1047 U.S. Highway, 127 South Suite 2
Frankfort, KY 40601
(502) 564-3070

Commissioner
Maryland Division of Labor and Industry
Department of Labor Licensing and Regulation
1100 N. Eutaw Street, Room 613
Baltimore, MD 21202-2206
(410) 767-2999

Director
Michigan Department of Consumer and Industry Services
4th Floor, Law Building
P.O. Box 30004
Lansing, MI 48909
(517) 373-7230
Commissioner

Minnesota Department of Labor and Industry
443 Lafayette Road
St. Paul, MN 55155
(612) 296-2342

Director
Nevada Division of Industrial Relations
400 West King Street
Carson City, NV 89710
(702) 687-3032

Secretary
New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
(505) 827-2850

Commissioner
New York Department of Labor

W. Averell Harriman State Office Building -12 Room 500 Albany, NY 12240 (518) 457-2741

Commissioner
North Carolina Department of Labor
319 Chapanoke Road
Raleigh, NC 27603
(919) 662-4585

Administrator
Department of Consumer and Business Services
Occupational Safety and Health Division (OR-OSHA)
350 Winter Street, N.E. Room 430
Salem, OR 97310
(503) 378-3272

Secretary
Puerto Rico Department of Labor and Human Resources
Prudencio Rivera Martinez Building
505 Munoz Rivera Avenue
Hato Rey, PR 00918
(809) 754-2119

Commissioner
South Carolina Department of Labor, Licensing, and Regulation
110 Centerview Drive
P.O. Box 11329
Columbia, SC 29211-1329
(803) 734-9594

Commissioner
Tennessee Department of Labor
Attention: Robert Taylor
710 James Robertson Parkway
Nashville, TN 37243-0659
(615) 741-2582

Commissioner
Industrial Commission of Utah
160 East 300 South, 3rd Floor
P.O. Box 146600
Salt Lake City, UT 84114-6600
(801) 530-6898

Commissioner
Vermont Department of Labor and Industry
National Life Building - Drawer 20
120 State Street
Montpelier, VT 05620
(802) 828-2288

Commissioner
Virgin Islands Department of Labor
2131 Hospital Street Box 890
Christiansted
St. Croix, VI 00820-4666
(809) 773-1994

Commissioner
Virginia Department of Labor and Industry
Powers-Taylor Building
13 South 13th Street
Richmond, VA 23219
(804) 786-2377

Director
Washington Department of Labor and Industries
General Administration Building
P.O. Box 44001
Olympia, WA 98504-4001
(360) 902-4200

Administrator
Workers' Safety and Compensation Division (WSC)
Wyoming Department of Employment
Herschler Building 2nd Floor East
122 West 25th Street
Cheyenne, WY 82002
(307) 777-7786

OSHA Consultation Project Directory

Alabama
(205) 348-7136

Alaska
(907) 269-4957

Arizona
(602) 542-5795

Arkansas
(501) 682-4532

California
(415) 972-8515

Colorado
(970) 491-6151

Connecticut
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District of Columbia
(202) 576-6339

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(904) 488-3044

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(404) 894-2646

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Hawaii
(808) 568-9100

Idaho
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Illinois
(312) 814-2337

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(913) 296-7476

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Louisiana
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Maine
(207) 624-6460

Maryland
(410) 880-4970

Massachusetts
(617) 727-3982

Michigan
(517) 332-1817(H)
(517) 322-1809(S)

Minnesota
(612) 297-2393

Mississippi
(601) 987-3981

Missouri
(573) 751-3403

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(406) 444-6418

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(402) 471-4717

Nevada
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New Hampshire
(603) 271-2024

New Jersey
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North Carolina
(919) 662-4644

North Dakota
(701) 328-5188

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(614) 644-2246

Oklahoma
(405) 528-1500

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(503) 378-3272

Pennsylvania
(412) 357-2561

Puerto Rico
(787) 754-2188

Rhode Island
(401) 277-2438

South Carolina
(803) 734-9614

South Dakota
(605) 688-4101

Tennessee
(615) 741-7036

Texas
(512) 440-3809

Utah
(801) 530-7606

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(802) 828-2765

Virginia
(804) 786-6359

Virgin Islands
(809) 772-1315

Washington
(360) 902-5638

West Virginia
(304) 558-7890

Wisconsin
(608) 266-8579(H)
(414) 521-5063(S)

Wyoming
(307) 777-3546
(H) - Health
(S) - Safety

OSHA Area Office Telephone Numbers

Albany, NY
(518) 464-4338

Albuquerque, NM
(505) 248-5302

Allentown, PA
(610) 776-0592

Anchorage, AK
(907) 271-5152

Appleton, WI
(414) 734-4521

Austin, TX
(512) 916-5783

Avenel, NJ
(908) 750-3270

Baltimore, MD
(410) 962-2840

Bangor, ME
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(504) 389-0474

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(718) 279-9060

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(205) 731-1534

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(701) 250-4521

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(203) 579-5581

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(708) 891-3800

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Charleston, WV
(304) 347-5937

Cincinnati, OH
(513) 841-4132

Cleveland, OH
(216) 522-3818

Columbia, SC
(803) 765-5904

Columbus, OH
(614) 469-5582

Concord, NH
(603) 225-1629

Corpus Christi, TX
(512) 888-3420

Dallas, TX
(214) 320-2400

Denver, CO
(303) 844-5285

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(847) 803-4800

Des Moines, IA
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Englewood, CO
(303) 843-4500

Erie, PA
(814) 833-5758

Fort Lauderdale, FL
(305) 424-0242

Fort Worth, TX
(817) 428-2470

Frankfort, KY
(502) 227-7024

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(717) 782-3902

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(860) 240-3152

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(201) 288-1700

Guaynabo, PA
(787) 277-1560

Honolulu, HI
(808) 541-2685

Houston, TX
(281) 286-0583

Houston, TX
(281) 591-2438

Indianapolis, IN
(317) 226-7290

Jackson, MS
(601) 965-4606

Jacksonville, FL
(904) 232-2895

Kansas City, MO
(816) 483-9531

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(517) 377-1892

Little Rock, AR
(501) 324-6291

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Madison, WI
(608) 264-5388

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Methuen, MA
(617) 565-8110

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Minneapolis, MN
(612) 664-4560

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Nashville, TN
(615) 781-5423

New York, NY
(212) 466-2482

Norfolk, VA
(804) 441-3820

North Aurora, IL
(630) 896-8700

Oklahoma City, OK
(405) 231-5351

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(402) 221-3182

Parsippany, NJ
(201) 263-1003

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Philadelphia, PA
(215) 597-4955

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(602) 640-2007

Pittsburgh, PA
(412) 644-2903

Portland, OR
(503) 326-2251

Providence, RI
(401) 528-4669

Raleigh, NC
(919) 856-4770

Salt Lake City, UT
(801) 524-5080

Sacramento, CA
(916) 566-7470

San Diego, CA
(619) 557-2909

Savannah, GA
(912) 652-4393

Smyrna, GA
(404) 984-8700

Springfield, MA
(413) 785-0123

St. Louis, MO
(314) 425-4249

Syracuse, NY
(315) 451-0808

Tampa, FL
(813) 626-1177

Tarrytown, NY
(914) 524-7510

Toledo, OH
(419) 259-7542

Tucker, GA
(770) 493-6644

Westbury, NY
(516) 334-3344

Wichita, KS
(316) 269-6644

Wilkes-Barre, PA
(717) 826-6538

Wilmington, DE
(302) 573-6115

OSHA Regional Offices

Region I
(CT,* MA, ME, NH, RI, VT*)
JFK Federal Building Room E-340
Boston, MA 02203
Telephone: (617) 565-9860

Region II
(NJ, NY,* PR,* VI*)
201 Varick Street Room 670
New York, NY 10014
Telephone: (212) 337-2378

Region III
(DC, DE, MD,* PA, VA,* WV)
Gateway Building, Suite 2100
3535 Market Street
Philadelphia, PA 19104
Telephone: (215) 596-1201

Region IV
(AL, FL, GA, KY,* MS, NC, SC,* TN*)
Atlanta Federal Center
61 Forsyth Street, S. W., Room 6T50
Atlanta, GA 30303
Telephone: (404) 562-2300

Region V
(IL, IN,* MI,* MN,* OH, WI)
230 South Dearborn Street Room 3244
Chicago, IL 60604
Telephone: (312) 353-2220

Region VI
(AR, LA, NM,* OK, TX)
525 Griffin Street Room 602
Dallas, TX 75202
Telephone: (214) 767-4731

Region VII
(IA,* KS, MO, NE)
City Center Square
1100 Main Street, Suite 800
Kansas City, MO 64105
Telephone: (816) 426-5861

Region VIII
(CO, MT, ND, SD, UT,* WY*)
1999 Broadway, Suite 1690
Denver, CO 80202-5716
Telephone: (303) 844-1600

Region IX
(American Samoa, AZ,* CA,* Guam, HI,* NV,* Trust Territories of the Pacific)
71 Stevenson Street Room 420
San Francisco, CA 94105
Telephone: (415) 975-4310

Region X
(AK,* ID, OR,* WA*)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
Telephone: (206) 553-5930

Footnote(1) U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, The Hazardous Waste System (Washington, DC, 1995), p. ES-2.
Footnote(2) If the employee has not had an examination within the last 6 months. Footnote(3) Emergency response to the release of hazardous substances beyond cleanup and TSD sites must also have plans that include these elements and other specific requirements as indicated in 1910.120 (q).
Footnote(4) A physical barricade, natural or man-made, that has been designed and constructed of sufficient thickness and density to withstand or deflect the impact loads of an adjacent explosion.
Footnote(5) A designated work area within the worksite.
Footnote(*) These states and territories operate their own OSHA-approved job safety and health programs (Connecticut and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.

Emergency response or responding to emergencies means a response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance.

Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

Glossary

The terms below are defined as they pertain to the Resource Conservation and Recovery Act.

Abandoned For purposes of defining a material as a solid waste under RCRA Subtitle C, a material that is disposed of, burned, or incinerated.

Accumulated Speculatively Storage of a material in lieu of expeditious recycling. Materials are usually accumulated speculatively if the waste being stored has no viable market or if a facility cannot demonstrate that at least 75 percent of the material has been recycled in a calendar year.

Acknowledgment of Consent Notice sent by the EPA to an exporter of hazardous waste, indicating that the importing country has agreed to accept such waste.

Action Levels For purposes of Subtitle C corrective action, risk-based concentrations of hazardous constituents in ground water, soil, or sediment that may trigger further investigation into possible contamination at a particular site.

Administrative Action Enforcement action taken by the EPA or a state under its own authority, without involving a judicial court process.

Administrative Procedures Act The Act that establishes rulemaking procedures as well as site-specific licensing procedures, access to agency information, and procedures and standards for judicial review of agency actions. All environmental rulemakings proposed and finalized by the EPA include public participation throughout the process.

Aggregation Points Centers that accept used oil only from places owned by the same owner and operator as the aggregation point, or from do-it- yourselfers.

Alternative Concentration Limits For purposes of TSDF ground water monitoring, hazardous constituent limits established by the EPA Regional Administrator that are allowed to be present in ground water.

Annual Aggregate For purposes of UST financial responsibility, the total amount of UST financial responsibility coverage required to cover all leaks that might occur in one year.

Applicable or Relevant and Appropriate Requirements Standards, criteria, or limitations under federal or more stringent state environmental laws, including RCRA, that may be required during a Superfund remedial action, unless site-specific waivers are obtained.

Authorized State A state that has been delegated the authority by the EPA to implement and enforce its own regulations for hazardous waste management under RCRA. The state program must be at least as stringent as the federal standards.

Automatic Tank Gauging A release detection method for USTs that uses a probe in the tank that is wired to a monitor to provide information on product level and temperature.

Basel Convention The international treaty that establishes standards for global trade of hazardous waste, municipal waste, and municipal incinerator ash. Because the United States is not a party to the convention, U.S. businesses can only export waste to those countries with which the U.S. government has negotiated a separate waste trade agreement.

Bentsen Wastes Geothermal exploration, development, and production waste exempt from RCRA Subtitle C regulation.

Best Demonstrated Available Technology The technology that best minimizes the mobility or toxicity (or both) of the hazardous constituents for a particular waste.

Bevill Wastes Fossil fuel combustion wastes, mining and mineral processing wastes, and cement kiln dust wastes exempt from RCRA Subtitle C regulation.

Biennial Report A report submitted by hazardous waste LQGs and TSDFs to enable the EPA and the states to track the quantities of hazardous waste generated and the movements of those hazardous wastes.

Boiler An enclosed device that uses controlled flame combustion to recover and deliver energy in the form of steam, heated fluid, or heated gases.

Bottom Ash Ash that collects at the bottom of a combustion chamber.

Burners Handlers who burn used oil for energy recovery in boilers, industrial furnaces, or hazardous waste incinerators.

Burning for Energy Recovery Burning hazardous waste for its heating value as a fuel, and using wastes to produce fuels or as ingredients in fuels.

By-Products Materials that are not one of the intended products of a production process and includes most wastes that are not spent materials or sludges.

California List Interim LDR treatment standards that ensured adequate protection of human health and the environment during the time the EPA was promulgating final LDR treatment standards.

Capacity Assurance Plan A written statement which ensures that a state has hazardous waste treatment and disposal capacity. This capacity must be for facilities that are in compliance with RCRA Subtitle C requirements and must be adequate to manage hazardous wastes projected to be generated within the state over 20 years.

Cathode Ray Tubes Vacuum tubes made primarily of glass, which constitute the video display component of televisions and computer monitors. These tubes are generally hazardous for lead.

Cathodic Protection A form of corrosion protection for USTs that uses sacrificial anodes or a direct current source to protect steel by halting the naturally occurring electrochemical process that causes corrosion.

Cement Kiln Type of industrial furnace that receives hazardous waste to burn as fuel to run its cement process. Cement is produced by heating mixtures of limestone and other minerals or additives at high temperatures in a rotary kiln, followed by cooling, grinding, and finish mixing.

Change in Service Using a formerly regulated UST system to store a nonregulated substance.

Characteristic Waste Waste that is considered hazardous under RCRA because it exhibits any of four different properties: ignitability, corrosivity, reactivity, and toxicity.

Civil Action A formal lawsuit, filed in court, against a person who has either failed to comply with a statutory or regulatory requirement or an administrative order, or against a person who has contributed to a release of hazardous waste or hazardous constituents.

Clean Air Act The Act that regulates air emissions from area, stationary, and mobile sources. CAA limits the emission of pollutants into the atmosphere in order to protect human health and the environment from the effects of airborne pollution.

Clean Closure The process of completely removing all waste that was treated, stored, or disposed in a hazardous waste unit.

Clean Water Act The Act that sets the basic structure for regulating discharges of pollutants to surface waters of the United States. CWA imposes contaminant limitations or guidelines for all discharges of wastewater into the nation's waterways.

Closure The procedure that a solid or hazardous waste management facility undergoes to cease operations and ensure protection of human health and the environment in the future.

Codification The process by which final regulations are incorporated into the CFR, which is published annually.

Collection Centers Centers that accept used oil from multiple sources, including both businesses and private citizens.

Combustion The controlled burning in an enclosed area as a means of treating or disposing of hazardous waste.

Commercial Chemical Products Unused or off-specification chemicals, spill or container residues, and other unused manufactured products that are not typically considered chemicals. For the purposes of hazardous waste listings, CCPs include only unused, pure chemical products and formulations.

Compliance Monitoring For purposes of RCRA TSDF ground water monitoring, a program that seeks to ensure that the amount of hazardous waste that has leaked into the uppermost aquifer does not exceed acceptable levels.

Composting Processes designed to optimize the natural decomposition or decay of organic matter, such as leaves and food. The end product of composting is a humus-like material that can be added to soils to increase soil fertility, aeration, and nutrient retention.

Comprehensive Environmental Response, Compensation, and Liability Act The Act that authorizes the EPA to clean up uncontrolled or abandoned hazardous waste sites and respond to accidents, spills and other emergency releases of hazardous substances. CERCLA provides the EPA with enforcement authority to ensure that responsible parties pay the cleanup costs of remediating a site contaminated with hazardous substances.

Comprehensive Environmental Response, Compensation, and Liability Information System A computerized database used to track hazardous substance sites.

Comprehensive Performance Testing The initial and periodic evaluation procedure for demonstrating compliance with the national emission standards for hazardous air pollutants and establishes revised operating limits for hazardous waste combustors.

Comprehensive Procurement Guidelines A list, updated every two years, which designates items with recycled content that procuring agencies should aim to purchase. This list currently contains 54 items within 8 product categories.

Concentration Limits For purposes of TSDF ground water monitoring, the maximum levels of hazardous constituents allowed to be present in the ground water.

Conditionally Exempt Small Quantity Generators Facilities that produce less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste, per calendar month. A CESQG may only accumulate less than 1,000 kg of hazardous waste, 1 kg of acutely hazardous waste, or 100 kg of spill residue from acutely hazardous waste at any one time.

Construction Quality Assurance A program required by the EPA to ensure that a landfill, surface impoundment, or waste pile meets all of the technological requirements.

Contained-In Policy An EPA policy that determines the health threats posed by contaminated environmental media and debris, and whether such materials must be managed as RCRA hazardous wastes.

Containers Portable devices, in which a material is stored, transported, treated, or otherwise handled.

Containment Building A completely enclosed structure used to store or treat noncontainerized waste.

Continuous Emission Monitoring Systems A system that directly and continuously measures one or more pollutants exiting a combustion unit.

Continuous Monitoring Systems A device which continuously samples the regulated parameter without interruption, evaluates the detector response at least once every 15 seconds, and computes and records the average value at least every 60 seconds.

Cooperative Agreement An agreement between a state and the EPA which ensures that the state will spend money from the LUST Trust Fund for its intended purpose.

Corporate Guarantee The demonstration that a corporate grandparent, corporate parent, or sibling corporation can meet financial assurance requirements on behalf of a TSDF owner and operator, or the financial responsibility requirements on behalf of a UST owner and operator. Firms with a "***substantial business relationship***" with a UST owner and operator can also make this demonstration.

Corrective Action An EPA program to address the investigation and cleanup of contamination from solid waste facilities, hazardous waste facilities, and USTs.

Corrective Action Management Unit A physical, geographical area designated by the EPA or states for managing remediation wastes during corrective action.

Corrosivity Characteristic The characteristic which identifies wastes that are acidic or alkaline (basic) and can readily corrode or dissolve flesh, metal, or other materials.

Counting Totaling the hazardous wastes at a given facility for a particular month in order to determine hazardous waste generator status.

Covered States States that participated in the EPA's medical waste tracking program from June 22, 1989 to June 22, 1991, which included Connecticut, New Jersey, New York, Rhode Island, and the Commonwealth of Puerto Rico.

Cradle to Grave The time period referring to the initial generation of hazardous waste to its ultimate disposal.

Criminal Action Enforcement action reserved for the most serious violations, which can result in fines or imprisonment.

De minimis Very small amounts of hazardous waste that are discharged to wastewater treatment facilities and thus, are exempt from the mixture rule. De minimis also refers to small concentrations of regulated substances in a UST.

Debris A broad category of large manufactured and naturally occurring objects that are commonly discarded (e.g., construction materials, decommissioned industrial equipment, discarded manufactured objects, tree trunks, boulders).

Delisting A site-specific petition process whereby a handler can demonstrate to the EPA that a particular wastestream generated at its facility that meets a listing description does not pose sufficient hazard to warrant RCRA regulation. Owners and operators can also use the delisting process for wastes that are hazardous under the mixture and derived-from rules that pose minimal hazard to human health and the environment.

Derived-From Rule A rule that regulates residues from the treatment of listed hazardous wastes.

Designated Facility A hazardous waste treatment, storage, or disposal facility which has received a RCRA permit (or interim status),or is a recycling facility regulated under 40 CFR Section 261.2(c)(2) or Subpart F, of Section 266,and has been designated on the manifest by the generator.

Destination Facilities Facilities that treat, dispose of, or recycle a particular category of universal waste.

Destruction and Removal Efficiency Standard which verifies that a combustion unit is destroying the organic components found in hazardous waste.

Detection Monitoring For purposes of RCRA TSDF ground water monitoring, the first step of monitoring at land disposal units, where the owner and operator monitors for indication of a leak from the unit, looking for potential changes in the ground water quality from normal (background)levels.

Dilution Prohibition The LDR requirement that prohibits the addition of soil or water to waste in order to reduce the concentrations of hazardous constituents instead of treatment by the appropriate LDR treatment standards.

Direct Discharges Discharges from point sources into surface water pursuant to a CWA NPDES permit.

Disposal The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid or hazardous waste on or in the land or water.

Disposal Prohibition The LDR requirement that prohibits the land disposal of hazardous waste that has not been adequately treated to reduce the threat posed by such waste.

Distillation Bottoms Residues that form at the bottom of a distillation unit.

Do-it-Yourselfers Individuals who generate used oil through the maintenance of their own personal vehicles and equipment and are not considered used oil generators.

Drip Pads Engineering structures consisting of a curbed, free-draining base, constructed of non-earthen materials, and designed to convey wood preservative chemical drippage from treated wood, precipitation, and surface water run-on to an associated collection system at wood preserving plants.

Elementary Neutralization Units Containers, tanks, tank systems, transportation vehicles, or vessels which neutralize wastes that are hazardous only for exhibiting the characteristic of corrosivity.

Emergency Planning and Community Right-to- Know Act The Act designed to help communities prepare to respond in the event of a chemical emergency and to increase the public's knowledge of the presence and threat of hazardous chemicals.

Environmental Justice The fair distribution of environmental risks across socioeconomic and racial groups.

Environmental Media Materials such as soil, surface water, ground water, and sediment.

EPA Identification Number A unique number assigned by the EPA to each hazardous waste generator, transporter, or treatment, storage, and disposal facility.

Episodic Generation The situation in which a generator's status changes from one month to the next, as determined by the amount of waste generated in a particular month. If a generator's status does in fact change, the generator is required to comply with the respective regulatory requirements for that class of generators for the waste generated in that particular month.

Equipment Each valve, pump, compressor, pressure relief device, sampling connection system, open-ended valve or line, or flange or other connector, and any other control devices or systems.

Exception Report A report, submitted by LQGs and SQGs, detailing efforts to locate wastes when a signed copy of the manifest has not been received.

Existing USTs USTs that were in service, or for which installation had commenced on or before December 22, 1988.

Extended Product Responsibility An approach to environmental protection that strives to reduce the environmental impacts of products.

Federal Insecticide, Fungicide, and Rodenticide Act The Act that provides procedures for the registration of pesticide products to control their introduction into the marketplace.

Federal Procurement Program A program that sets minimum recycled content standards for certain designated items and requires procuring agencies to purchase those items composed of the highest percentage of recovered materials practicable.

Final Authorization Authorization by the EPA that indicates that a state's program is equivalent to, or no less stringent than, as well as consistent with, federal hazardous waste regulations.

Financial Assurance Under RCRA Subtitle C, the requirements designed to ensure that TSDF owners and operators will have the financial resources to pay for closure, post-closure, and liability costs. Under RCRA Subtitle D, the requirements designed to ensure that MSWLF owners and operators will have the financial resources to pay for closure, post-closure, and corrective action costs.

Financial Test A test of self-insurance which demonstrates that an owner and operator has sufficient financial strength to satisfy TSDF financial assurance or UST financial responsibility requirements.

Float The lighter materials present in petroleum refinery wastewater. As components of oily waste, float rises to the surface in the first step of wastewater treatment.

Fly Ash Particles of ash, such as particulate matter which may also have metals attached to them, that are carried up the stack of a combustion unit with gases during combustion.

Formal Action An enforcement action, frequently in the form of an administrative order, that is taken when a serious violation is detected, or when the owner and operator does not respond to an informal administrative action.

Freedom of Information Act The Act that grants private parties the right to obtain information in the government's possession. FOIA requires each federal agency to establish procedures for handling requests regarding government statutes, regulations, standards, permit conditions, requirements, orders, and policies.

Full Cost Accounting An accounting approach that helps local governments identify all direct and indirect costs, as well as the past and future costs, of a municipal solid waste management program.

Generator Any person whose act first creates or produces a hazardous waste, used oil, or medical waste, or first brings such materials into RCRA regulation.

Green Buildings Buildings that are designed, constructed, operated, and ultimately removed in such a way as to minimize their environmental impact.

Ground Water Monitoring Sampling and analysis of ground water for the purpose of detecting the release of contamination from a solid or hazardous waste land-based unit. Ground water monitoring is also a method of UST release detection which senses the presence of liquid product floating in ground water.

Hammer Provisions Requirements written directly into RCRA by Congress, as in the case of the Hazardous and Solid Waste Amendments of 1984, that would automatically become regulations if the EPA failed to issue its own regulations by certain dates.

Hazard Communication Standard The OSHA standard that provides workers with access to information about the hazards and identities of the chemicals they are exposed to while working, as well as the measures they can take to protect themselves.

Hazard Ranking System A model devised under CERCLA that determines the relative risk to public health and the environment posed by hazardous substances in ground water, surface water, air, and soil. Only those sites with a score of 28.5 (on a scale of 0 to 100) are eligible for placement on the NPL.

Hazardous Constituents For purposes of RCRA TSDF ground water monitoring, those constituents that have been detected in the uppermost aquifer and are reasonably expected to be in or derived from the waste contained in the unit.

Hazardous Substance A comprehensive designation under CERCLA for RCRA hazardous wastes as well as other toxic pollutants regulated by CAA, CWA, and TSCA. EPA has the authority under CERCLA to designate any additional element, compound, mixture, or solution as a hazardous substance. The definition of hazardous substance specifically excludes petroleum and natural gas.

Hazardous Waste A waste with properties that make it dangerous, or capable of having a harmful effect on human health and the environment. Under the RCRA program, hazardous wastes are specifically defined as wastes that meet a particular listing description or that exhibit a characteristic of hazardous waste.

Hazardous Waste Operations and Emergency Response Worker Protection Standard The OSHA standard that protects the health and safety of workers engaged in operations at hazardous waste sites, hazardous waste treatment facilities, and emergency response locations.

Ignitability characteristic The characteristic which identifies wastes that can readily catch fire and sustain combustion.

Incinerator An enclosed device that uses controlled flame combustion and does not meet the criteria for classification as a boiler, industrial furnace, sludge dryer (a unit that dehydrates hazardous sludge), or carbon regeneration unit (a unit that regenerates spent activated carbon). Incinerators also include infrared incinerators (units that use electric heat followed by a controlled flame afterburner) and plasma arc incinerators (units that use electrical discharge followed by a controlled flame afterburner).

Incorporation by Reference This occurs when the regulatory language in a state's regulation actually cite, or refer to, the federal regulations.

Indirect Discharges Wastewater that is first sent to a POTW, and then after treatment by the POTW, discharged pursuant to a NPDES permit.

Industrial Ecology The study of material and energy flows and their transformations into products, byproducts, and wastes throughout industrial and ecological systems.

Industrial Furnace An enclosed unit that is an integral part of a manufacturing process and uses thermal treatment to recover materials or energy from hazardous waste.

Informal Administrative Action Any communication from the EPA or a state agency that notifies the handler of a problem.

Inherently Waste-Like For purposes of defining a material as a solid waste under RCRA Subtitle C, a material, such as dioxin-containing wastes, that is always considered a solid waste because of its intrinsic threat to human health and the environment.

Insurance A policy to cover the TSDF financial assurance or UST financial responsibility requirements.

Interim Authorization A temporary mechanism that is intended to promote continued state participation in hazardous waste management while encouraging states to develop programs that are fully equivalent to the federal program and will qualify for final authorization.

Interim Measures Under RCRA Subtitle C corrective action, short-term actions to control ongoing risks while site characterization is underway or before a final remedy is selected.

Interim Status Facilities TSDFs that were already in operation when the RCRA standards were established and that are operating under less stringent standards until they receive a permit.

Interstitial Monitoring UST release detection method that involves the use of secondary containment, such as a barrier, outer wall, vault, or liner around the UST or piping to prevent leaking product from escaping into the environment. If product escapes from the inner tank or piping, it will then be directed towards an interstitial monitor located between the walls.

Inventory Control An UST release detection method that involves taking measurements of tank contents, recording the amount of product pumped each operating day, and reconciling this data at least once a month to determine if a tank is leaking.

Jobs through Recycling A program the EPA launched in 1994 to support recycling markets. The goal of the program is to foster markets for recycled goods by promoting and assisting the development of businesses using recovered materials, creating new recycling jobs, and spurring innovative technologies.

Lab Packs Drums filled with many small containers packed in nonbiodegradable absorbent materials.

Land Disposal For purposes of RCRA Subtitle C regulation, placement in or on the land, except in a corrective action unit of hazardous waste, and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or placement in a concrete vault, or bunker intended for disposal purposes.

Land Treatment Units Also known as land farms, land treatment units involve the application of hazardous waste on the soil surface, or the incorporation of waste into the upper layers of the soil in order to degrade, transform, or immobilize hazardous constituents present in hazardous waste.

Landfill For purposes of RCRA Subtitle C, a disposal unit where nonliquid hazardous waste is placed in or on the land.

Large Quantity Generators Facilities that generate more than 1,000 kg of hazardous waste per calendar month, or more than 1 kg of acutely hazardous waste per calendar month.

Large Quantity Handlers of Universal Waste
Handlers that accumulate a total of 5000 kg or more of universal waste at any one time.

Leachate Any liquid, including any suspended components in the liquid, that has percolated through or drained from waste.

Leaking Underground Storage Tank Trust Fund A fund created by SARA that provides money for overseeing corrective action taken by a responsible party, and provides money for cleanups at UST sites where the owner and operator is unknown, unwilling, or unable to respond.

Letter of Credit A credit document issued to an owner and operator to cover TSDF financial assurance or UST financial responsibility requirements.

Liabilities Damages that may result from an unexpected release of contaminants into the environment.

Lightweight Aggregate Kiln Type of industrial furnace that produces lightweight aggregate and burns liquid hazardous waste as fuel to run its process. Lightweight aggregate refers to a wide variety of raw materials (such as clay, shale, or slate) which, after thermal processing, can be combined with cement to form concrete products. Lightweight aggregate is produced either for structural or thermal insulation purposes.

Listed Wastes Wastes that are considered hazardous under RCRA because they meet specific listing descriptions.

Manifest Paperwork that accompanies hazardous waste from the point of generation to the point of ultimate treatment, storage, or disposal. Each party involved in the waste's management retains a copy of the RCRA manifest, which contains specific information about the waste.

Manual Tank Gauging A method of UST leak detection that requires keeping the tank undisturbed for at least 36 hours per week, during which time the contents of the tank are measured to determine if the tank is leaking.

Marine Protection, Research, and Sanctuaries Act This Act requires a permit for any material that is transported from a U.S. port or by a U.S. vessel for disposition at sea.

Marketers Used oil handlers who either 1) direct shipments of used oil to be burned as fuel in regulated devices, or 2) claim that used oil to be burned for energy recovery is on-specification.

Maximum Achievable Control Technology Process Technology-based concentration limits developed under CAA to limit emissions of individual constituents from hazardous waste combustion units.

Maximum Contaminant Levels For purposes of RCRA ground water monitoring, contaminant-specific levels borrowed from SDWA that are the maximum levels of hazardous waste or hazardous constituents allowed to be present in the groundwater.

Medical Waste Culture and stocks of infectious agents, human pathological wastes, human blood and blood products, used sharps, certain animal wastes, certain isolation wastes, and unused sharps.

Memorandum of Agreement An agreement between a state's director and its EPA Regional Administrator outlining the nature of the responsibilities to enforce a regulatory program and defining the level of coordination and oversight between the EPA and the state agency.

Military Munitions For purposes of defining a material as a solid waste under RCRA Subtitle C, ammunition products and components produced for or used by the military for national defense and security.

Miscellaneous Units Hazardous waste treatment, storage, or disposal units regulated under RCRA that do not meet any of the other definitions of regulated units.

Mixed Waste Radioactive waste that is also a hazardous waste under RCRA. Such wastes are jointly regulated by RCRA and the Atomic Energy Act.

Mixture Rule A rule that is intended to ensure the regulation of mixtures of listed wastes with nonhazardous solid wastes.

Municipal Solid Waste Durable goods (e.g., appliances, tires, batteries), nondurable goods (e.g., newspapers, books, magazines), containers and packaging, food wastes, yard trimmings, and miscellaneous or anic wastes from residential, commercial, and industrial nonprocess sources.

Municipal Solid Waste Landfill A discrete area of land or excavation that receives municipal solid waste.

National Ambient Air Quality Standards Regulations promulgated by the EPA under the Clean Air Act for six criteria pollutants — sulfur dioxide,, particulate matter, nitrogen dioxide, carbon monoxide, ozone, and lead — in order to protect the public from toxic emissions to the atmosphere.

National Corrective Action Prioritization System A resource management tool by which the EPA sets priorities for the Subtitle C corrective action program.

National Emission Standards for Hazardous Air Pollutants Standards set by the EPA under the Clean Air Act to control emissions from specific industrial sources.

National Oil and Hazardous Substances Pollution Contingency Plan The NCP contains the regulations that implement the CERCLA response process. The NCP also provides information about the roles and responsibilities of the EPA, other federal agencies, states, and private parties regarding releases of hazardous substances.

National Priorities List EPA's priority hazardous substance sites for cleanup. EPA only funds remedial actions at hazardous waste sites on the NPL.

New USTs USTs that are installed, or for which installation has commenced, after December 22, 1988.New USTs must be installed in compliance with all of the applicable technical standards.

Nonsudden Accidental Occurrences For purposes of TSDF financial assurance, events that take place over time and involve continuous or repeated exposure to hazardous waste.

Notice of Deficiency A notice requiring that a TSDF permit applicant supply more information for a complete permit application.

Notice of Intent to Deny A notice issued by a permitting agency which tells a TSDF permit applicant that the application does not demonstrate compliance with the RCRA standards.

Notice of Noncompliance An informal letter to a handler written as part of an informal administrative action.

Notice of Violation An informal letter to a handler written as part of an informal administrative action.

Occupational Safety and Health Act The Act that is designed to save lives, prevent injuries, and protect the health of employees in the workplace. OSHA accomplishes these goals through several regulatory requirements including the HCS and HAZWOPER standards.

OECD Council Decision A multilateral agreement by the Organization for Economic Cooperation and Development that establishes procedural and substantive controls for the import and export of recyclables between member nations. Because the United States is a member of the OECD, U.S. businesses can trade recyclables with other member nations.

Off-Specification Used Oil Used oil that is tested and does not meet given parameters for arsenic, cadmium, chromium, flash point, lead, and total halogens.

Omnibus Provision The authority which allows the EPA to add conditions to a TSDF permit that are not specifically addressed by the RCRA regulations.

On-Specification Used Oil Used oil that meets all the given parameters for arsenic, cadmium, chromium, flash point, lead, and total halogens.

Open Dumps Solid waste disposal facilities that fail to comply with the Subtitle D criteria.

Operating Requirements Parameters established by a facility and written into a permit that will ensure a combustion unit meets numerical performance standards.

Operation and Maintenance The operation and maintenance phase of the CERCLA response process. Operation and maintenance may include activities such as ground water pump and treat, and cap maintenance. The EPA conducts review of operation and maintenance activities to ensure that the remedy selected is still protective of human health and the environment.

Overfilling When a state fails to enforce its hazardous waste program properly, the EPA can overfile, or enforce a provision for which a particular state has authorization.

Particulate Matter Small dust-like particles emitted from hazardous waste combustion units.

Payment Bond For purposes of TSDF financial assurance, a type of surety bond that will fund a standby trust fund in the amount equal to the value of the bond.

Per Occurrence For purposes of UST financial responsibility, the amount of money that must be available to pay for the costs from one leak.

Performance Bond For purposes of TSDF financial assurance, a type of surety bond that guarantees that an owner and operator will comply with their closure, post-closure, and liability requirements.

Performance Standards The numerical pollutant emission limits for hazardous waste combustion units developed by the EPA.

Permanent Closure Closure of a UST that involves a number of steps designed to ensure that the tank will pose no threat to human health or the environment after it is closed.

Permit-as-a-Shield The provision which ensures that TSDF permittees will not be enforced against for violating new requirements that were not established in the original permit.

Permit-by-Rule A special form of a RCRA permit that is sometimes granted to facilities with permits for activities under other environmental laws.

Permitted Facilities Facilities that have obtained a TSDF permit from the EPA or the state agency to engage in the treatment, storage, or disposal of hazardous waste.

Point of Compliance For purposes of RCRA TSDF ground water monitoring, the vertical point where a TSDF owner and operator must monitor the uppermost aquifer to determine if the leak exceeds the ground water protection standard.

Point Source Discharges Discharges of treated wastewater directly into a lake, river, stream, or other water body. Point source discharges are regulated under CWA.

Pollutants or Contaminants Any element, substance, compound, or mixture that, after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, will or may reasonably be anticipated to cause illness, death, or deformation in any organism. The definition of pollutant or contaminant specifically excludes petroleum and natural gas.

Post-Closure Period after closure during which owners and operators of solid or hazardous waste disposal units conduct monitoring and maintenance activities in order to preserve the integrity of the disposal system.

Potentially Responsible Party The person or persons who may be held liable for hazardous substance contamination under CERCLA. PRPs may include the owners and operators, generators, transporters, and disposers of the hazardous substances.

Precious Metals Reclamation The recycling and recovery of precious metals (i.e., gold, silver, platinum, palladium, iridium, osmium rhodium, and ruthenium) from hazardous waste.

Preliminary Assessment A review of all readily available site information such as maps, deeds, and other records to determine if further CERCLA response action is necessary. During the PA, the EPA tries to determine what type of substances may have
been released and the potential impacts to human health and the environment.

Principal Organic Hazardous Constituents Selected or anic constituents, which are high in concentration and difficult to burn, that are monitored to ensure a hazardous waste combustion unit's destruction and removal efficiency.

Process Vent Any open-ended pipe or stack that is vented to the atmosphere either directly, through a vacuum-producing system, or through a tank associated with hazardous waste distillation, fractionation, thin-film evaporation solvent extraction, or air or steam stripping operations.

Processors and Rerefiners Facilities that process used oil so that it can be burned for energy recovery or reused.

Procuring Agency Agencies that purchase $10,000 or more worth of an item designated under the federal procurement program during the course of a fiscal year. Procuring agencies include: federal government departments or agencies; state government agencies that use appropriated federal funds for procurement of a designated item; local government agencies that use appropriated federal funds for procurement of a designated item, and government contractors that work on a project funded by appropriated federal funds with respect to work performed under the contract.

Publicly Owned Treatment Works A municipal wastewater treatment plant that receives domestic sewage from households, office buildings, factories, and other places where people live and work. Treatment at a POTW is regulated by the CWA.

RCRAInfo A database that tracks RCRA Subtitle C facility-specific data (i.e., events and activities related to hazardous waste generators, transporters, and TSDFs), and hazardous waste activity reports, known as biennial reports, that are submitted by LQGs and TSDFs.

Reactivity Characteristic The characteristic which identifies wastes that readily explode or under violent reactions.

Rebuttable Presumption For purposes of RCRA, an objective test that focuses on the halogen level in used oil to determine whether the used oil has been mixed with a listed hazardous waste.

Reclaimed For purposes of defining a material as a solid waste under RCRA Subtitle C, a material is reclaimed if it is processed to recover a usable product, or regenerated by processing it in a way that restores it to usable condition.

Record of Decision A remedial action plan document that describes the remedy selected for a Superfund site.

Recovered Materials Advisory Notice A notice that provides suggested recycled content levels and other purchasing information for each item designated in the CPG. Procuring agencies can use these levels as guidelines, but are encouraged to exceed the EPA's recommendations.

Recovered Materials Content Levels The minimum amount of recovered material that designated items under the federal procurement program should contain.

Recycled For purposes of defining a material as a solid waste under RCRA Subtitle C, a material is recycled if it is used or reused, or reclaimed.

Recycling The separation and collection of wastes, their subsequent transformation or remanufacture into usable or marketable products or materials, and the purchase of products made from recyclable materials.

Recycling Presumption The assumption that all used oil that is generated will be recycled.

Regulated Community The group of organizations, people, industries, businesses, and agencies that, because they perform certain activities, fall under the purview of RCRA.

Regulated Substance For purposes of UST regulation, any hazardous substance defined under CERCLA §101(14) and petroleum.

Regulations Rules issued by an agency, such as the EPA, that translate the general mandate of a statute into a set of requirements that the regulated community and the agency must work within.

Remedial Action Longer-term CERCLA response actions that ultimately represent the final remedy for a site and generally are more expensive and of a longer duration than removals.

Remedial Action Plans Special form of RCRA permit that a facility may obtain to treat, store, or dispose of hazardous remediation waste at a remediation waste management site.

Remedial Design/Remedial Action Remedial design is a phase in the CERCLA response process in which technical drawings are developed for the chosen remedy, costs for implementing the remedy are estimated, and roles and responsibilities of the EPA, states and contractors are determined. During the remedial action phase, the remedy is implemented generally by a contractor, with oversight and inspection conducted by the EPA or the state (or both).

Remedial Investigation/Feasibility Study A remedial investigation is a phase in the CERCLA response process that entails an in-depth examination of the nature and extent of contamination at a site and the associated risks to human health and the environment. The feasibility study entails an analysis of remedial action alternatives comparing the advantages and disadvantages of each.

Remediation Waste All solid and hazardous wastes, and all media (including ground water, surface water, soils, and sediments) and debris that are managed for implementing cleanup.

Removal Action Short-term cleanup action taken under CERCLA that usually addresses problems only at the surface of a site. A removal is conducted in response to an emergency, and generally is limited to 12 months duration or $2 million in expenditures.

Risk Retention Groups For purposes of UST financial responsibility, entities formed by businesses or individuals with similar risks to provide insurance coverage for those risks.

Risk-Based Decision-Making A process that uses risk and exposure assessment concepts to help UST implementing agencies establish enforcement priorities.

Rulemakings Rules issued by an agency, such as the EPA, that translate the general mandate of a statute into a set of requirements that the regulated community and the agency must work within.

Safe Drinking Water Act The Act designed to protect the nation's drinking water supply by establishing national drinking water standards (MCLs or specific treatment techniques),and by regulating UIC wells.

Scrap Metal Worn or extra bits and pieces of metal parts, such as scrap piping and wire, or worn metal items, such as scrap automobiles and radiators.

Secondary Materials The five categories of solid wastes regulated under Subtitle C, which include: spent materials, by-products, sludges, commercial chemical products, and scrap metal.

Sham Recycling Illegitimate activities executed under the guise of recycling in order to be exempt from or subject to lesser regulation.

Site Inspection An in-depth assessment of on-site conditions, conducted as part of the CERCLA response process, to rank the site's hazard potential by determining the site's hazard ranking system score. Activities to assess the site may include sampling, field reconnaissance, and examination of site records (e.g., topographical maps, logs).

Sludges Any solid, semisolid, or liquid wastes generated from a wastewater treatment plant, water supply treatment plant, or air pollution control device.

Small Quantity Generators Facilities that generate between 100 kg and 1,000 kg of hazardous waste per calendar month.

Small Quantity Handlers of Universal Waste Handlers that do not accumulate 5000 kg of all universal waste categories combined at their location at any one time.

Sole Active Ingredient For purposes of determining if a waste is P or U listed the only chemical ingredient serving the function of a commercial product formulation.

Solid Waste Any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material, resulting from industrial, commercial, mining, and agricultural operations and from community activities. For the purposes of hazardous waste regulation, a solid waste is a material that is discarded by being either abandoned, inherently waste-like, a certain waste military munition, or recycled.

Solid Waste Management Units For purposes of Subtitle C corrective action, discernible units where solid or hazardous wastes have been placed at any time, or any area where solid wastes have been routinely and systematically released.

Source Reduction Maximizing or reducing the use of natural resources at the beginning of an industrial process, thereby eliminating the amount of waste produced by the process. Source reduction is the EPA's preferred method of waste management.

Spent Materials Materials that have been used and can no longer serve the purpose for which they were produced without processing.

Spill Prevention Control and Countermeasures Regulations establishing spill prevention procedures and equipment requirements for nontransportation-related facilities with certain aboveground or underground storage capacities that could reasonably be expected to discharge oil into or upon the navigable waters of the United States or adjoining shorelines.

Staging Pile An accumulation of solid, non-flowing remediation waste that is not a containment building and that is used only during remedial operations for temporary storage at a facility.

State Assurance Funds For purposes of UST financial responsibility, state funds that are used to help pay for cleanup and third-party liability costs resulting from leaking USTs.

State Authorization Tracking System A tool used by the EPA to chart those states that have been authorized to implement the RCRA hazardous waste program.

Statistical Inventory Reconciliation A UST release detection method that involves using sophisticated computer software to conduct a statistical analysis of inventory, delivery, and dispensing data in order to determine if a tank is leaking.

Storage Holding hazardous waste for a temporary period, after which the hazardous waste is treated, disposed of, or stored elsewhere.

Storage Prohibition LDR provision that prevents the indefinite storage of untreated hazardous waste for reasons other than the accumulation of quantities necessary for effective treatment or disposal.

Sudden Accidental Occurrences For purposes of TSDF financial assurance, events that are not continuous or repeated.

Superfund The common name for CERCLA. Superfund refers to the entire CERCLA program as well as the trust fund established to fund cleanup of contaminated sites where potentially responsible parties cannot be identified, or are unwilling or unable to pay.

Superfund Amendments and Reauthorization Act SARA, enacted in 1986, reauthorized and amended CERCLA to include additional enforcement authorities, technical requirements, community involvement requirements, and various clarifications. SARA Title III authorized EPCRA.

Supplemental Environmental Projects Environmentally beneficial projects which a defendant or respondent agrees to undertake in the settlement of a civil or administrative enforcement action, but which the defendant is not otherwise legally required to perform.

Surety Bond A guarantee which certifies that a surety company will cover TSDF financial assurance or UST financial responsibility requirements on behalf of the owner and operator.

Surface Impoundment A natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials that is used to treat, store, or dispose of hazardous waste.

Tank Tightness Testing A variety of UST release detection methods used to determine if a tank is leaking; most of these methods involve monitoring changes in product level or volume in a tank over a period of several hours.

Tanks Stationary devices used to store or treat hazardous waste.

Technical Grade For purposes of determining if a waste is P or U listed, a commercial chemical product that is not 100 percent pure, but is of a grade of purity that is either marketed or recognized in general usage by the chemical industry.

Temporary Closure A method by which a UST owner and operator can close a tank temporarily and bring it back into service at a later date. The owner and operator must continue to operate and maintain the corrosion protection system and the leak detection system if any product remains in the tank.

Temporary Units Containers or tanks that are designed to manage remediation wastes during corrective action at permitted or interim status facilities.

Thermal Treatment The treatment of hazardous waste in a device that uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the waste.

Totally Enclosed Treatment Units Units that are designed and constructed to practically eliminate the potential for hazardous wastes to escape into the environment during treatment.

Toxic Substances Control Act The Act that controls the manufacture and sale of certain chemical substances.

Toxicity Characteristic The characteristic which identifies wastes that are likely to leach dangerous concentrations of toxic chemicals into ground water.

Toxicity Characteristic Leaching Procedure A lab procedure designed to predict whether a particular waste is likely to leach chemicals into ground water at dangerous levels.

Transfer Facilities Any transportation-related facility such as loading docks, parking areas, storage areas, or other similar areas where shipments of hazardous waste, used oil, or universal waste are held temporarily during the normal course of transportation.

Transporter Any person engaged in the off-site transportation of hazardous waste, used oil, universal waste, or medical waste.

Treatment Any method, technique, or process designed to physically, chemically, or biologically change the nature of a hazardous waste.

Treatment Standards LDR criteria that hazardous waste must meet before it is disposed.

Treatment, Storage, and Disposal Facilities Facilities engaged in the treatment, storage, or disposal of hazardous waste. These facilities are the last link in the cradle-to-grave hazardous waste management system.

Trial Burn Burn conducted to test the performance of a hazardous waste combustion unit over a range of conditions.

Trust Fund A financial mechanism by which a facility can set aside money in order to cover the TSDF financial assurance or UST financial responsibility requirements.

Underground Injection Control Well Units into which hazardous waste is permanently disposed of by injection 1/4 mile below an aquifer with an underground source of drinking water (as defined under SDWA).

Underground Storage Tanks A tank and any underground piping connected to the tank that is used to contain an accumulation of regulated substances and that has at least 10 percent of its combined volume underground.

Underlying Hazardous Constituents Constituents that must be treated in order to meet contaminant-specific levels for purposes of the LDR program.

Unit Pricing An economic incentive program used to achieve source reduction and recycling, also called variable rate refuse collection, where customers who dispose of more waste pay more for the collection and disposal services.

Universal Treatment Standards Contaminant-specific hazardous waste LDR treatment levels.

Universal Wastes Commonly recycled wastes with special management provisions intended to facilitate recycling. There are four categories of universal wastes: hazardous waste batteries, hazardous waste pesticides that have been recalled or collected in waste pesticide collection programs, hazardous waste lamps, and hazardous waste thermostats.

Upgrading Retrofitting existing USTs to come into compliance with the UST regulations. The upgrading period expires on December 22,1998.

Use Constituting Disposal The direct placement of wastes or waste-derived products (e.g., asphalt with petroleum refining wastes as an ingredient) on the land.

Used Oil Any oil that has been refined from crude or synthetic oil that has been used and, as a result of such use, is contaminated by physical or chemical impurities.

UST field Abandoned or underutilized industrial and commercial properties where redevelopment is complicated by real or perceived environmental petroleum contamination from federally-regulated USTs.

Vapor Monitoring A UST release detection method in which the equipment measures product fumes in the soil around the UST to check for leaks.

Violation The act or an instance of breaking or disregarding the law.

Waste Analysis Plan A plan that outlines the procedures necessary to ensure proper treatment, storage, or disposal of hazardous waste.

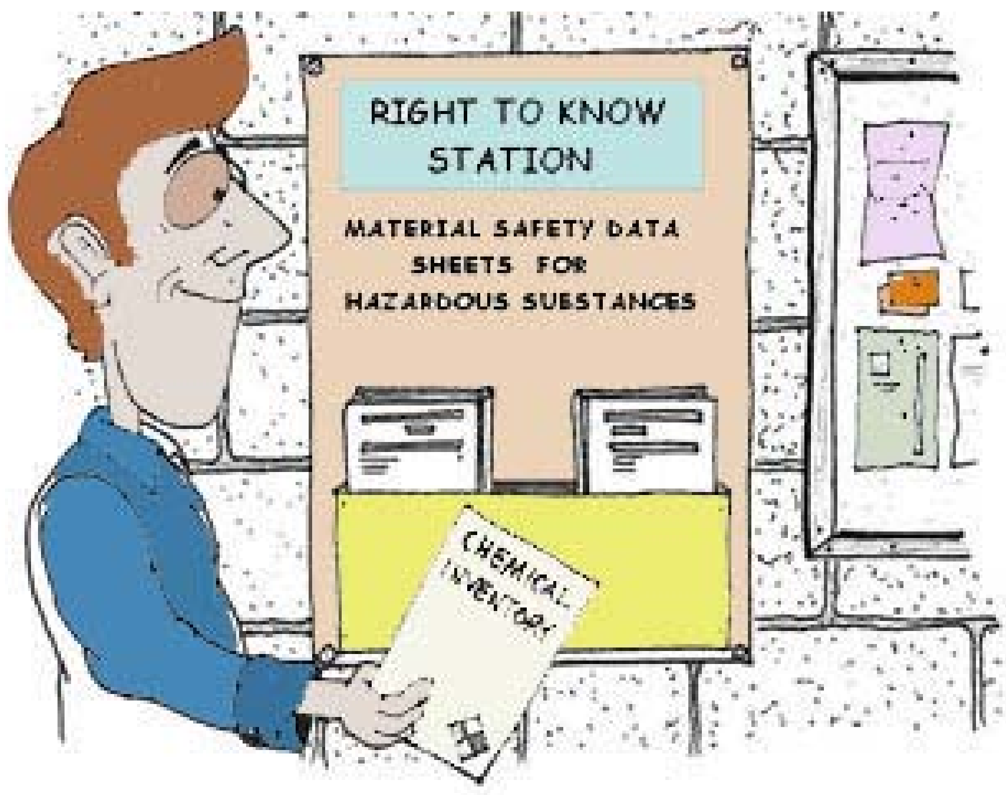
Waste Minimization The reduction, to the extent feasible, in the amount of hazardous waste generated prior to any treatment, storage, or disposal of the waste. Because waste minimization efforts eliminate waste before it is generated, disposal costs may be reduced, and the impact on the environment may be lessened.

Waste Pile An open pile used for treating or storing nonliquid hazardous waste.

Wastewater Treatment Units Tanks or tank systems that treat hazardous wastewaters and discharge them pursuant to CWA.

WasteWi$e A program designed to assist companies, states, local governments, Native American tribes, and other institutions in developing cost-effective practices to reduce solid waste.

Zero Discharges Wastewater that is not directly or indirectly discharged to a navigable water (e.g., wastewater that is land disposed through spray irrigation) under CWA. Zero discharge facilities are subject to federal or state regulatory limitations that are as strict as those that apply to direct and indirect dischargers under CWA.



LDR Glossary

Area of Contamination (AOC) Policy: The EPA interprets RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units. Therefore consolidation of material within an AOC and treatment of material, in situ, within an AOC does ***NOT CREATE A POINT OF HAZARDOUS WASTE GENERATION FOR PURPOSES OF RCRA.***

Best Demonstrated Available Technology (BDAT): The treatment technology that best minimizes the mobility or toxicity (or both) of the hazardous constituents for a particular waste.

Characteristic Waste: Waste that is considered hazardous under RCRA because it exhibits any four different properties: ignitability, corrosivity, reactivity, and toxicity.

Contained-in Determination for Soil: Granted by the EPA or an authorized state that certifies that soil is no longer considered a hazardous waste. You can apply for a contained-in determination if soil should not be managed as a hazardous waste because:
(1) the soil does not exhibit a characteristic of hazardous waste when generated, or
(2) the soil contaminated with a listed hazardous waste has concentrations of hazardous constituents that are below health-based levels.

Contained-in Policy: The "***contained-in***" policy dates back to a 1986 memorandum which states that although groundwater is not a solid waste, it can be considered a hazardous waste if it "***contains***" a hazardous waste. This policy was then applied to soil and debris.

Debris: Any solid material exceeding a 60 mm particle size that is intended for disposal and that is a manufactured object, or plant or animal matter, or natural geologic material.

Decharacterize: Treat a characteristic waste so that it no longer exhibits a characteristic property. For characteristic wastes treated in Clean Water Act and Safe Drinking water Act systems, decharacterize means dilution.

Determination of Equivalent Treatment (DET): A type of variance from the treatment standards in 40 CFR 268.40; applicable when a technology is specified as the treatment standard. Allows an alternative technology to be used in lieu of the specified technology, if the petitioner can demonstrate that the alternative technology can achieve a measure of performance equivalent to that of the specified technology.

Generator: Any person whose act first creates or produces hazardous waste.

Hazardous and Solid Waste Amendments (HSWA): Amendments to RCRA, enacted in 1984.

Listed Waste: Wastes that are considered hazardous under RCRA because they meet specific listing descriptions.

Mixed Waste: Radioactive waste that is also a hazardous waste under RCRA. Such wastes are jointly regulated by RCRA and the Atomic Energy Act.

Non-Analyzable Constituents: Constituents that lack appropriate test methods or chemical standards and therefore cannot be properly measured to determine compliance with LDR concentration-based standards in 268.40 and 268.48.

Nonwastewater (NWW): Wastes that do not meet the criteria for wastewaters defined below.

Point of generation (POG) of a Hazardous Waste: The point at which a waste is first determined to be hazardous. For listed wastes this is the point at which the waste first meets the listing description, and for characteristic wastes it is the point the waste first exhibits the characteristic.

Prohibited Wastes: Wastes that have to meet their treatment standards before land disposal.

Restricted Wastes: Wastes that have LDR treatment standards, but can be land disposed without treatment because of an exemption (e.g., a capacity variance).

Soil: Unconsolidated earth material composing the superficial geologic strata (material overlying bedrock) consisting of clay, silt, sand or gravel size particles as classified by the U.S. Soil Conservation Service, or a mixture of such materials with liquids, sludges or solids which is inseparable by simple mechanical removal processes and is made up primarily of soil by volume based on visual inspection.

Subtitle C Landfill: A landfill that accepts hazardous waste (including treated hazardous waste).

Subtitle D Landfill: A landfill that accepts nonhazardous waste.

Total Waste Analysis: Analytic test method used to measure compliance with most of the organic treatment standards. Carbon disulfide, cyclohexanone, and methanol treatment standards are measured using toxicity characteristic leaching procedure.

Toxicity Characteristic Leaching Procedure (TCLP): Analytic test method used to measure compliance with the metal treatment standards.

Transfer Facilities: Any transportation-related facility such as loading docks, parking areas, storage areas, or other similar areas where shipments of hazardous waste are temporarily held during the normal course of transportation.

Transporter: Any person engaged in the off-site transportation of hazardous waste by air, rail, highway, or water.

Treatability Group: A grouping of hazardous wastes that can be treated to similar concentrations using identical technologies.

Treatment, Storage, Disposal Facilities: Facilities engaged in the treatment, storage, or disposal of hazardous waste.

Underlying Hazardous Constituent (UHC): Any constituent listed in 40 CFR 268.48, "**Table UTS - Universal Treatment Standards**", except fluoride, selenium, sulfide, vanadium, and zinc, which can reasonably be expected to be present at the point of generation of the hazardous waste, at a concentration above the constituent-specific universal treatment standard.

Universal Treatment Standards (UTS): These are the constituent-specific treatment standards found in §268.48.

Use Constituting Disposal: The direct placement of recycled materials, that is, wastes or waste derived-products, on the land. Note: remediation activities involving replacement of treated soils onto the land are not a type of use constituting disposal, in part, because it is a supervised remediation instead of an unsupervised recycling activity.

Waste Analysis Plan (WAP): A plan that outlines the procedures necessary to ensure proper treatment, storage, or disposal of hazardous waste.

It may take two or three people to properly fit a person in to a class a suit. There are many procedures to ensure a proper fit and too ensure the air respirator is working properly, plus you need to time the person in the suit and monitor the medical conditions. If you can get thirty minutes in a class A suit, you are doing extremely well. Most people last 15 minutes and then a break. It is the heat that takes a person down.

ENVIRONMENTAL CONTACTS EPA INFORMATION SERVICES

Center for Environmental Research and Information (CERI),
Office of Research and Development (ORD)..(513)569-7562
www.epa.gov/ORD/publications

Clean Air Technology Center ....(919)541-0800
www.epa.gov/ttn/catc

Environmental Appeals Board (EAB)..(201)501-7060
www.epa.gov/eab

Environmental Justice Hotline ....(800)962-6215
www.epa.gov/compliance/environmentaljustice/index.html

Environmental Recycling Hotline/Earth 's 911.......................................(800)253-2687
www.earth911.org

Human Resources..(202)564-4606
www.epa.gov/epahrist

Indoor Air Quality Clearinghouse ....(800)438-4318
www.epa.gov/iaq

Information Resource Center (IRC)...(202)260-5922
www.epa.gov/natlibra/hqirc

Methods Information Communication Exchange
(MICE or Test Methods Hotline)...(703)676-4690
www.epa.gov/epaoswer/hazwaste/test/mice.htm

National Lead Information Center ....(800)424-5323
www.epa.gov/lead/nlic.htm

National Radon Hotline ....(800)767-7236
www.epa.gov/iaq/radon/

National Service Center for Environmental Publications.......................(800)490-9198
www.epa.gov/ncepihom/G-2

National Pesticides Information Center;
Federal Insecticide, Fungicide, and Rodenticide Act ....(800)858-7378
npic.orst.edu/

Office of Atmospheric Programs ....(202)564-9140
www.epa.gov/ozone

Office of Congressional &Intergovernmental Relations ....(202)564-5200
www.epa.gov/ocir

Pay-As-You-Throw Helpline ....(888)372-7298
www.epa.gov/payt

RCRA, Superfund & EPCRA Call Center ....(800)424-9346
www.epa.gov/epaoswer/hotline

Safe Drinking Water Hotline ....(800)426-4791
www.epa.gov/safewater

Toxic Substances Control Act Hotline ....(202)554-1404

WasteWise ....(800)372-9473
www.epa.gov/wastewise

Wetlands Protection Hotline ....(800)832-7828
www.epa.gov/owow/wetlands/wetline.html

EPA DOCKETS

Office of Air and Radiation ....(202)566-1742

Office of Enforcement and Compliance Assurance ....(202)566-1514

Office of Solid Waste and Emergency Response
RCRA/UST ....(202)566-0270

Superfund/Oil ....(202)566-0276

Office of Environmental Information (Toxics Release Inventory)..................(202)566-1752

Office of Pollution, Prevention, and Toxics ....(202)566-0280

Office of Water ....(202)566-2426

FEDERAL GOVERNMENT INFORMATION SERVICES

Agency for Toxic Substances and Disease Registry TSDR).........................(888)422-8737
www.atsdr.cdc.gov/

Council for Environmental Quality; National Environmental Policy Act ....(202)395-5750
www.whitehouse.gov/ceq

Federal Consumer Information Center ....(800)333-4636
www.pueblo.gsa.gov

Federal Information Center ....(800)688-9889
www.info.gov

Government Printing Office...(202)512-1800
www.access.gpo.gov

Hazardous Materials Information Center ....(800)467-4922
hazmat.dot.gov

National Technical Information Service ....(800)553-6847
www.ntis.gov

National Institute for Occupational Safety and Health (NIOSH)...................(800)356-4647
www.cdc.gov/niosh

National Response Center ....(800)424-8802
www.nrc.uscg.mil

Nuclear Regulatory Commission ....(301)415-8200
www.nrc.gov

Occupational Safety and Health Administration (OSHA)
Compliance Guidance Group ....(301)515-6796

Health hazard means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

HAZWOPER Standard Part Number: 1910
• Part Title: Occupational Safety and Health Standards
• Subpart: H
• Subpart Title: Hazardous Materials
• Standard Number: 1910.120
• Title: Hazardous waste operations and emergency response.

1910.120(a)
Scope, application, and definitions. --

1910.120(a)(1)
Scope. This section covers the following operations, unless the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards:

1910.120(a)(1)(i)
Clean-up operations required by a governmental body, whether Federal, state local or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority Site List (NPL), state priority site lists, sites recommended for the EPA NPL, and initial investigations of government identified sites which are conducted before the presence or absence of hazardous substances has been ascertained);

1910.120(a)(1)(ii)
Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 et seq);
..1910.120(a)(1)(iii)

1910.120(a)(1)(iii)
Voluntary clean-up operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites;

1910.120(a)(1)(iv)
Operations involving hazardous waste that are conducted at treatment, storage, disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA; or by agencies under agreement with U.S.E.P.A. to implement RCRA regulations; and

1910.120(a)(1)(v)
Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

1910.120(a)(2) Application.

1910.120(a)(2)(i)
All requirements of Part 1910 and Part 1926 of Title 29 of the Code of Federal Regulations apply pursuant to their terms to hazardous waste and emergency response operations whether covered by this section or not. If there is a conflict or overlap, the provision more protective of employee safety and health shall apply without regard to 29 CFR 1910.5(c)(1).
1910.120(a)(2)(ii)

Hazardous substance clean-up operations within the scope of paragraphs (a)(1)(i) through (a)(1)(iii) of this section must comply with all paragraphs of this section except paragraphs (p) and (q).

1910.120(a)(2)(iii)
Operations within the scope of paragraph (a)(1)(iv) of this section must comply only with the requirements of paragraph (p) of this section.

Notes and Exceptions:
1910.120(a)(2)(iii)(A)
All provisions of paragraph (p) of this section cover any treatment, storage or disposal (TSD) operation regulated by 40 CFR parts 264 and 265 or by state law authorized under RCRA, and required to have a permit or interim status from EPA pursuant to 40 CFR 270.1 or from a state agency pursuant to RCRA.

1910.120(a)(2)(iii)(B)
Employers who are not required to have a permit or interim status because they are conditionally exempt small quantity generators under 40 CFR 261.5 or are generators who qualify under 40 CFR 262.34 for exemptions from regulation under 40 CFR parts 264, 265 and 270 ("***excepted employers***") are not covered by paragraphs (p)(1) through (p)(7) of this section. Excepted employers who are required by the EPA or state agency to have their employees engage in emergency response or who direct their employees to engage in emergency response are covered by paragraph (p)(8) of this section, and cannot be exempted by (p)(8)(i) of this section.
..1910.120(a)(2)(iii)(C)

1910.120(a)(2)(iii)(C)
If an area is used primarily for treatment, storage or disposal, any emergency response operations in that area shall comply with paragraph (p) (8) of this section. In other areas not used primarily for treatment, storage, or disposal, any emergency response operations shall comply with paragraph (q) of this section. Compliance with the requirements of paragraph (q) of this section shall be deemed to be in compliance with the requirements of paragraph (p)(8) of this section.

1910.120(a)(2)(iv)
Emergency response operations for releases of, or substantial threats of releases of, hazardous substances which are not covered by paragraphs (a)(1)(i) through (a)(1)(iv) of this section must only comply with the requirements of paragraph (q) of this section.

1910.120(a)(3)
Definitions --

Buddy system means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

Clean-up operation means an operation where hazardous substances are removed, contained, incinerated, neutralized, stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of making the site safer for people or the environment.

Decontamination means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

Emergency response or responding to emergencies means a response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance.

Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

Facility means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel.

Hazardous materials response (***HAZMAT***) team means an organized group of employees, designated by the employer, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance.

The team members perform responses to releases or potential releases of hazardous substances for the purpose of control or stabilization of the incident. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade or fire department.

Hazardous substance means any substance designated or listed under (A) through (D) of this definition, exposure to which results or may result in adverse effects on the health or safety of employees:

[A] Any substance defined under section 101(14) of CERCLA;

[B] Any biologic agent and other disease causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring.

[C] Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices; and

[D] Hazardous waste as herein defined.

Hazardous waste means --

[A] A waste or combination of wastes as defined in 40 CFR 261.3, or

[B] Those substances defined as hazardous wastes in 49 CFR 171.8.

Hazardous waste operation means any operation conducted within the scope of this standard.

Hazardous waste site or Site means any facility or location within the scope of this standard at which hazardous waste operations take place.

Health hazard means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

The term "***health hazard***" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. It also includes stress due to temperature extremes. Further definition of the terms used above can be found in Appendix A to 29 CFR 1910.1200.

IDLH or Immediately dangerous to life or health means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere.

Oxygen deficiency means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

Permissible exposure limit means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subparts G and Z.

Published exposure level means the exposure limits published in "***NIOSH Recommendations for Occupational Health Standards"*** dated 1986, which is incorporated by reference as specified in § 1910.6, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1987-88" dated 1987, which is incorporated by reference as specified in § 1910.6.

Post emergency response means that portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees who were part of the initial emergency response, it is considered to be part of the initial response and not post emergency response.

However, if a group of an employer's own employees, separate from the group providing initial response, performs the clean-up operation, then the separate group of employees would be considered to be performing post-emergency response and subject to paragraph (q)(11) of this section.

Qualified person means a person with specific training, knowledge and experience in the area for which the person has the responsibility and the authority to control.

Site safety and health supervisor (or official) means the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

Small quantity generator means a generator of hazardous wastes who in any calendar month generates no more than 1,000 kilograms (2,205) pounds of hazardous waste in that month.

Uncontrolled hazardous waste site means an area identified as an uncontrolled hazardous waste site by a governmental body, whether Federal, state, local or other where an accumulation of hazardous substances creates a threat to the health and safety of individuals or the environment or both.

Some sites are found on public lands such as those created by former municipal, county or state landfills where illegal or poorly managed waste disposal has taken place.

Other sites are found on private property, often belonging to generators or former generators of hazardous substance wastes. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSD sites are not covered by this definition.

1910.120(b)
Safety and health program.

NOTE TO (b): Safety and health programs developed and implemented to meet other federal, state, or local regulations are considered acceptable in meeting this requirement if they cover or are modified to cover the topics required in this paragraph. An additional or separate safety and health program is not required by this paragraph.

1910.120(b)(1)
General.

1910.120(b)(1)(i)
Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations.

1910.120(b)(1)(ii)
The written safety and health program shall incorporate the following:

1910.120(b)(1)(ii)(A)
An organizational structure;

1910.120(b)(1)(ii)(B)
A comprehensive workplan;

..1910.120(b)(1)(ii)(C)

1910.120(b)(1)(ii)(C)
A site-specific safety and health plan which need not repeat the employer's standard operating procedures required in paragraph (b)(1)(ii)(F) of this section;

1910.120(b)(1)(ii)(D)
The safety and health training program;

1910.120(b)(1)(ii)(E)
The medical surveillance program;

1910.120(b)(1)(ii)(F)
The employer's standard operating procedures for safety and health; and

1910.120(b)(1)(ii)(G)
Any necessary interface between general program and site specific activities.

1910.120(b)(1)(iii)
Site excavation. Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with Subpart P of 29 CFR Part 1926.

1910.120(b)(1)(iv)
Contractors and sub-contractors. An employer who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer's information program.

1910.120(b)(1)(v)
Program availability. The written safety and health program shall be made available to any contractor or subcontractor or their representative who will be involved with the hazardous waste operation; to employees; to employee designated representatives; to OSHA personnel, and to personnel of other Federal, state, or local agencies with regulatory authority over the site.

1910.120(b)(2)
Organizational structure part of the site program. --

1910.120(b)(2)(i)
The organizational structure part of the program shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees. It shall include, at a minimum, the following elements:

1910.120(b)(2)(i)(A)
A general supervisor who has the responsibility and authority to direct all hazardous waste operations.

1910.120(b)(2)(i)(B)
A site safety and health supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance.

1910.120(b)(2)(i)(C)
All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.

1910.120(b)(2)(i)(D)
The lines of authority, responsibility, and communication.

1910.120(b)(2)(ii)
The organizational structure shall be reviewed and updated as necessary to reflect the current status of waste site operations.
..1910.120(b)(3)

1910.120(b)(3)
Comprehensive workplan part of the site program. The comprehensive workplan part of the program shall address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives.

1910.120(b)(3)(i)
The comprehensive workplan shall address anticipated clean-up activities as well as normal operating procedures which need not repeat the employer's procedures available elsewhere.
1910.120(b)(3)(ii)

The comprehensive workplan shall define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.

1910.120(b)(3)(iii)
The comprehensive workplan shall establish personnel requirements for implementing the plan.

1910.120(b)(3)(iv)
The comprehensive workplan shall provide for the implementation of the training required in paragraph (e) of this section.

1910.120(b)(3)(v)
The comprehensive workplan shall provide for the implementation of the required informational programs required in paragraph (i) of this section.

1910.120(b)(3)(vi)
The comprehensive workplan shall provide for the implementation of the medical surveillance program described in paragraph (f) if this section.

1910.120(b)(4)
Site-specific safety and health plan part of the program. --

1910.120(b)(4)(i)
General. The site safety and health plan, which must be kept on site, shall address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection.

1910.120(b)(4)(ii)
Elements. The site safety and health plan, as a minimum, shall address the following:

1910.120(b)(4)(ii)(A)
A safety and health risk or hazard analysis for each site task and operation found in the workplan.

1910.120(b)(4)(ii)(B)
Employee training assignments to assure compliance with paragraph (e) of this section.

1910.120(b)(4)(ii)(C)
Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in paragraph (g)(5) of this section.

1910.120(b)(4)(ii)(D)
Medical surveillance requirements in accordance with the program in paragraph (f) of this section.

1910.120(b)(4)(ii)(E)
Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
..1910.120(b)(4)(ii)(F)

1910.120(b)(4)(ii)(F)
Site control measures in accordance with the site control program required in paragraph (d) of this section.

1910.120(b)(4)(ii)(G)
Decontamination procedures in accordance with paragraph (k) of this section.

1910.120(b)(4)(ii)(H)
An emergency response plan meeting the requirements of paragraph (l) of this section for safe and effective responses to emergencies, including the necessary PPE and other equipment.

1910.120(b)(4)(ii)(I)
Confined space entry procedures.

1910.120(b)(4)(ii)(J)
A spill containment program meeting the requirements of paragraph (j) of this section.

1910.120(b)(4)(iii)
Pre-entry briefing. The site specific safety and health plan shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed. The information and data obtained from site characterization and analysis work required in paragraph (c) of this section shall be used to prepare and update the site safety and health plan.

1910.120(b)(4)(iv)
Effectiveness of site safety and health plan. Inspections shall be conducted by the site safety and health supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on behalf of the employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.

1910.120(c)
Site characterization and analysis --

1910.120(c)(1)
General. Hazardous waste sites shall be evaluated in accordance with this paragraph to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

1910.120(c)(2)
Preliminary evaluation. A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person in order to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

1910.120(c)(3)
Hazard identification. All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (**IDLH**) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

1910.120(c)(4)
Required information. The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:

1910.120(c)(4)(i)
Location and approximate size of the site.

1910.120(c)(4)(ii)
Description of the response activity and/or the job task to be performed.

1910.120(c)(4)(iii)
Duration of the planned employee activity.

1910.120(c)(4)(iv)
Site topography and accessibility by air and roads.

1910.120(c)(4)(v)
Safety and health hazards expected at the site.

1910.120(c)(4)(vi)
Pathways for hazardous substance dispersion.

1910.120(c)(4)(vii)
Present status and capabilities of emergency response teams that would provide assistance to on-site employees at the time of an emergency.

1910.120(c)(4)(viii)
Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.
..1910.120(c)(5)

1910.120(c)(5)
Personal protective equipment. Personal protective equipment (**PPE**) shall be provided and used during initial site entry in accordance with the following requirements:

1910.120(c)(5)(i)
Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.

1910.120(c)(5)(ii)
If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by employees during initial site entry.

1910.120(c)(5)(iii)
If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site an ensemble providing equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions. (See Appendix B for guidelines on Level B protective equipment.)

1910.120(c)(5)(iv)
Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with paragraph (g) of this section.

1910.120(c)(6)
Monitoring. The following monitoring shall be conducted during initial site entry when the site evaluation produces information which shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient reasonably to eliminate these possible conditions:

1910.120(c)(6)(i)
Monitoring with direct reading instruments for hazardous levels of ionizing radiation.

1910.120(c)(6)(ii)
Monitoring the air with appropriate direct reading test equipment for (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances.)

1910.120(c)(6)(iii)
Visually observing for signs of actual or potential IDLH or other dangerous conditions.

1910.120(c)(6)(iv)
An ongoing air monitoring program in accordance with paragraph (h) of this section shall be implemented after site characterization has determined the site is safe for the start-up of operations.

1910.120(c)(7)
Risk identification. Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication Standard, 29 CFR 1910.1200, training required by that standard need not be duplicated.

NOTE TO PARAGRAPH (c)(7). **- *Risks to consider include, but are not limited to:***

[a] Exposures exceeding the permissible exposure limits and published exposure levels.
[b] IDLH Concentrations.
[c] Potential Skin Absorption and Irritation Sources.
[d] Potential Eye Irritation Sources.
[e] Explosion Sensitivity and Flammability Ranges.
[f] Oxygen deficiency.

1910.120(c)(8)
Employee notification. Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities. The employer may utilize information developed for the hazard communication standard for this purpose.

1910.120(d)
Site control. --

1910.120(d)(1)
General. Appropriate site control procedures shall be implemented to control employee exposure to hazardous substances before clean-up work begins.
..1910.120(d)(2)

1910.120(d)(2)
Site control program. A site control program for protecting employees which is part of the employer's site safety and health program required in paragraph (b) of this section shall be developed during the planning stages of a hazardous waste clean-up operation and modified as necessary as new information becomes available.

1910.120(d)(3)
Elements of the site control program. The site control program shall, as a minimum, include: A site map; site work zones; the use of a "***buddy system***"; site communications including alerting means for emergencies; the standard operating procedures or safe work practices; and, identification of the nearest medical assistance. Where these requirements are covered elsewhere they need not be repeated.

1910.120(e)
Training. --

1910.120(e)(1)
General.

1910.120(e)(1)(i)
All employees working on site (such as but not limited to equipment operators, general laborers and others) exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the site shall receive training meeting the requirements of this paragraph before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training as specified in this paragraph.

1910.120(e)(1)(ii)
Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.

1910.120(e)(2)
Elements to be covered. The training shall thoroughly cover the following:

1910.120(e)(2)(i)
Names of personnel and alternates responsible for site safety and health;

1910.120(e)(2)(ii)
Safety, health and other hazards present on the site;

1910.120(e)(2)(iii)
Use of personal protective equipment;

1910.120(e)(2)(iv)
Work practices by which the employee can minimize risks from hazards;

1910.120(e)(2)(v)
Safe use of engineering controls and equipment on the site;

1910.120(e)(2)(vi)
Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards; and

1910.120(e)(2)(vii)
The contents of paragraphs (G) through (J) of the site safety and health plan set forth in paragraph (b)(4)(ii) of this section.
..1910.120(e)(3)

1910.120(e)(3)
Initial training.

1910.120(e)(3)(i)
General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained experienced supervisor.

1910.120(e)(3)(ii)
Workers on site only occasionally for a specific limited task (such as, but not limited to, ground water monitoring, land surveying, or geophysical surveying) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

1910.120(e)(3)(iii)
Workers regularly on site who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits and published exposure limits where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

1910.120(e)(3)(iv)
Workers with 24 hours of training who are covered by paragraphs (e)(3)(ii) and (e)(3)(iii) of this section, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified in paragraph (e)(3)(i).

1910.120(e)(4)
Management and supervisor training. On-site management and supervisors directly responsible for or who supervise employees engaged in hazardous waste operations shall receive 40 hours initial and three days of supervised field experience (the training may be reduced to 24 hours and one day if the only area of their responsibility is employees covered by paragraphs (e)(3)(ii) and (e)(3)(iii) and at least eight additional hours of specialized training at the time of job assignment on such topics as, but no limited to, the employer's safety and health program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques.

1910.120(e)(5)
Qualifications for trainers. Trainers shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactorily completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.

1910.120(e)(6)
Training certification. Employees and supervisors that have received and successfully completed the training and field experience specified in paragraphs (e)(1) through (e)(4) of this section shall be certified by their instructor or the head instructor and trained supervisor as having completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified or who does not meet the requirements of paragraph (e)(9) of this section shall be prohibited from engaging in hazardous waste operations.

1910.120(e)(7)
Emergency response. Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to such expected emergencies.

1910.120(e)(8)
Refresher training. Employees specified in paragraph (e)(1) of this section, and managers and supervisors specified in paragraph (e)(4) of this section, shall receive eight hours of refresher training annually on the items specified in paragraph (e)(2) and/or (e)(4) of this section, any critique of incidents that have occurred in the past year that can serve as training examples of related work, and other relevant topics.

1910.120(e)(9)
Equivalent training. Employers who can show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to that training required in paragraphs (e)(1) through (e)(4) of this section shall not be required to provide the initial training requirements of those paragraphs to such employees and shall provide a copy of the certification or documentation to the employee upon request. However, certified employees or employees with equivalent training new to a site shall receive appropriate, site specific training before site entry and have appropriate supervised field experience at the new site. Equivalent training includes any academic training or the training that existing employees might have already received from actual hazardous waste site experience.

1910.120(f)
Medical surveillance --

1910.120(f)(1)
General. Employees engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section and not covered by (a)(2)(iii) exceptions and employers of employees specified in paragraph (q)(9) shall institute a medical surveillance program in accordance with this paragraph.

1910.120(f)(2)
Employees covered. The medical surveillance program shall be instituted by the employer for the following employees:

1910.120(f)(2)(i)
All employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;

1910.120(f)(2)(ii)
All employees who wear a respirator for 30 days or more a year or as required by 1910.134;

1910.120(f)(2)(iii)
All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and

1910.120(f)(2)(iv)
Members of HAZMAT teams.

1910.120(f)(3)
Frequency of medical examinations and consultations. Medical examinations and consultations shall be made available by the employer to each employee covered under paragraph (f)(2) of this section on the following schedules:

1910.120(f)(3)(i)
For employees covered under paragraphs (f)(2)(i), (f)(2)(ii), and (f)(2)(iv);

1910.120(f)(3)(i)(A)
Prior to assignment;

1910.120(f)(3)(i)(B)
At least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate;
..1910.120(f)(3)(i)(C)

1910.120(f)(3)(i)(C)
At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.

1910.120(f)(3)(i)(D)
As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation;

1910.120(f)(3)(i)(E)
At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

1910.120(f)(3)(ii)
For employees covered under paragraph (f)(2)(iii) and for all employees including of employers covered by paragraph (a)(1)(iv) who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used:

1910.120(f)(3)(ii)(A)
As soon as possible following the emergency incident or development of signs or symptoms;

1910.120(f)(3)(ii)(B)
At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

1910.120(f)(4)
Content of medical examinations and consultations.

1910.120(f)(4)(i)
Medical examinations required by paragraph (f)(3) of this section shall include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

1910.120(f)(4)(ii)
The content of medical examinations or consultations made available to employees pursuant to paragraph (f) shall be determined by the attending physician. The guidelines in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (See Appendix D, reference # 10) should be consulted.

1910.120(f)(5)
Examination by a physician and costs. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

1910.120(f)(6)
Information provided to the physician. The employer shall provide one copy of this standard and its appendices to the attending physician and in addition the following for each employee:

1910.120(f)(6)(i)
A description of the employee's duties as they relate to the employee's exposures,

1910.120(f)(6)(ii)
The employee's exposure levels or anticipated exposure levels.

1910.120(f)(6)(iii)
A description of any personal protective equipment used or to be used.

1910.120(f)(6)(iv)
Information from previous medical examinations of the employee which is not readily available to the examining physician.

1910.120(f)(6)(v)
Information required by §1910.134.

1910.120(f)(7)
Physician's written opinion.

1910.120(f)(7)(i)
The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

1910.120(f)(7)(i)(A)
The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.
..1910.120(f)(7)(i)(B)

1910.120(f)(7)(i)(B)
The physician's recommended limitations upon the employees assigned work.

1910.120(f)(7)(i)(C)
The results of the medical examination and tests if requested by the employee.

1910.120(f)(7)(i)(D)
A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

1910.120(f)(7)(ii)
The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposure.

1910.120(f)(8)
Recordkeeping.

1910.120(f)(8)(i)
An accurate record of the medical surveillance required by paragraph (f) of this section shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.

1910.120(f)(8)(ii)
The record required in paragraph (f)(8)(i) of this section shall include at least the following information:

1910.120(f)(8)(ii)(A)
The name and social security number of the employee;

1910.120(f)(8)(ii)(B)
Physicians' written opinions, recommended limitations and results of examinations and tests;

1910.120(f)(8)(ii)(C)
Any employee medical complaints related to exposure to hazardous substances;

1910.120(f)(8)(ii)(D)
A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.

1910.120(g)
Engineering controls, work practices, and personal protective equipment for employee protection. Engineering controls, work practices and PPE for substances regulated in Subpart Z. (i) Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with this paragraph to protect employees from exposure to hazardous substances and safety and health hazards.

1910.120(g)(1)
Engineering controls, work practices and PPE for substances regulated in Subparts G and Z.

1910.120(g)(1)(i)
Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the permissible exposure limits for substances regulated by 29 CFR Part 1910, to the extent required by Subpart Z, except to the extent that such controls and practices are not feasible.

NOTE TO PARAGRAPH (g)(1)(i): Engineering controls which may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all non-essential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

1910.120(g)(1)(ii)
Whenever engineering controls and work practices are not feasible, or not required, any reasonable combination of engineering controls, work practices and PPE shall be used to reduce and maintain to or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

1910.120(g)(1)(iii)
The employer shall not implement a schedule of employee rotation as a means of compliance with permissible exposure limits or dose limits except when there is no other feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

1910.120(g)(1)(iv)
The provisions of 29 CFR, subpart G, shall be followed.

1910.120(g)(2)
Engineering controls, work practices, and PPE for substances not regulated in Subparts G and Z. An appropriate combination of engineering controls, work practices, and personal protective equipment shall be used to reduce and maintain employee exposure to or below published exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Z. The employer may use the published literature and MSDS as a guide in making the employer's determination as to what level of protection the employer believes is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

1910.120(g)(3)
Personal protective equipment selection.

1910.120(g)(3)(i)
Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.
..1910.120(g)(3)(ii)

1910.120(g)(3)(ii)
Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

1910.120(g)(3)(iii)
Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

1910.120(g)(3)(iv)
Totally-encapsulating chemical protective suits (protection equivalent to Level A protection as recommended in Appendix B) shall be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

1910.120(g)(3)(v)
The level of protection provided by PPE selection shall be increased when additional information or site conditions show that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure levels for hazardous substances and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

NOTE TO PARAGRAPH (g)(3): The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

1910.120(g)(3)(vi)
Personal protective equipment shall be selected and used to meet the requirements of 29 CFR Part 1910, Subpart I, and additional requirements specified in this section.

1910.120(g)(4)
Totally-encapsulating chemical protective suits.

1910.120(g)(4)(i)
Totally-encapsulating suits shall protect employees from the particular hazards which are identified during site characterization and analysis.

1910.120(g)(4)(ii)
Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A for a test method which may be used to evaluate this requirement.)

1910.120(g)(4)(iii)
Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A for a test method which may be used to evaluate this requirement.)

1910.120(g)(5)
Personal protective equipment (PPE) program. A personal protective equipment program, which is part of the employer's safety and health program required in paragraph (b) of this section or required in paragraph (p)(1) of this section and which is also a part of the site-specific safety and health plan shall be established. The PPE program shall address the elements listed below. When elements, such as donning and doffing procedures, are provided by the manufacturer of a piece of equipment and are attached to the plan, they need not be rewritten into the plan as long as they adequately address the procedure or element.

1910.120(g)(5)(i)
PPE selection based upon site hazards,

1910.120(g)(5)(ii)
PPE use and limitations of the equipment,
..1910.120(g)(5)(iii)

1910.120(g)(5)(iii)
Work mission duration,

1910.120(g)(5)(iv)
PPE maintenance and storage,

1910.120(g)(5)(v)
PPE decontamination and disposal,

1910.120(g)(5)(vi)
PPE training and proper fitting,

1910.120(g)(5)(vii)
PPE donning and doffing procedures,

1910.120(g)(5)(viii)
PPE inspection procedures prior to, during, and after use,

1910.120(g)(5)(ix)
Evaluation of the effectiveness of the PPE program, and

1910.120(g)(5)(x)
Limitations during temperature extremes, heat stress, and other appropriate medical considerations.

1910.120(h)
Monitoring. --

1910.120(h)(1)
General.

1910.120(h)(1)(i)
Monitoring shall be performed in accordance with this paragraph where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or published exposure levels if there are no permissible exposure limits, for hazardous substances.

1910.120(h)(1)(ii)
Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of employee protection needed on site.

1910.120(h)(2)
Initial entry. Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over permissible exposure limits or published exposure levels, exposure over a radioactive material's dose limits or other dangerous condition such as the presence of flammable atmospheres, oxygen-deficient environments.

1910.120(h)(3)
Periodic monitoring. Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

1910.120(h)(3)(i)
When work begins on a different portion of the site.

1910.120(h)(3)(ii)
When contaminants other than those previously identified are being handled.
..1910.120(h)(3)(iii)

1910.120(h)(3)(iii)
When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)

1910.120(h)(3)(iv)
When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)

1910.120(h)(4)
Monitoring of high-risk employees. After the actual clean-up phase of any hazardous waste operation commences; for example, when soil, surface water or containers are moved or disturbed; the employer shall monitor those employees likely to have the highest exposures to those hazardous substances and health hazards likely to be present above permissible exposure limits or published exposure levels by using personal sampling frequently enough to characterize employee exposures.

The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated in the first sentence of this paragraph. If the employees likely to have the highest exposure are over permissible exposure limits or published exposure limits, then monitoring shall continue to determine all employees likely to be above those limits. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated above.

NOTE TO PARAGRAPH (h): It is not required to monitor employees engaged in site characterization operations covered by paragraph (c) of this section.

1910.120(i)
Informational programs. Employers shall develop and implement a program which is part of the employer's safety and health program required in paragraph (b) of this section to inform employees, contractors, and subcontractors (or their representative) actually engaged in hazardous waste operations of the nature, level and degree of exposure likely as a result of participation in such hazardous waste operations. Employees, contractors and subcontractors working outside of the operations part of a site are not covered by this standard.

1910.120(j)
Handling drums and containers --

1910.120(j)(1)
General.

1910.120(j)(1)(i)
Hazardous substances and contaminated, liquids and other residues shall be handled, transported, labeled, and disposed of in accordance with this paragraph.

1910.120(j)(1)(ii)
Drums and containers used during the clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the wastes that they contain.

1910.120(j)(1)(iii)
When practical, drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.

1910.120(j)(1)(iv)
Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

1910.120(j)(1)(v)
Site operations shall be organized to minimize the amount of drum or container movement.

1910.120(j)(1)(vi)
Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

1910.120(j)(1)(vii)
U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

1910.120(j)(1)(viii)
Where major spills may occur, a spill containment program, which is part of the employer's safety and health program required in paragraph (b) of this section, shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

1910.120(j)(1)(ix)
Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

1910.120(j)(1)(x)
A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of buried drums or containers.

1910.120(j)(1)(xi)
Soil or covering material shall be removed with caution to prevent drum or container rupture.

1910.120(j)(1)(xii)
Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.

1910.120(j)(2)
Opening drums and containers. The following procedures shall be followed in areas where drums or containers are being opened:
1910.120(j)(2)(i)
Where an airline respirator system is used, connections to the source of air supply shall be protected from contamination and the entire system shall be protected from physical damage.

1910.120(j)(2)(ii)
Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

1910.120(j)(2)(iii)
If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

1910.120(j)(2)(iv)
Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.
..1910.120(j)(2)(v)

1910.120(j)(2)(v)
When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be of the type to prevent sources of ignition.

1910.120(j)(2)(vi)
Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

1910.120(j)(2)(vii)
Employees shall not stand upon or work from drums or containers.

1910.120(j)(3)
Material handling equipment. Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers.

910.120(j)(4)
Radioactive wastes. Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.

1910.120(j)(5)
Shock sensitive wastes. As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:

1910.120(j)(5)(i)
All non-essential employees shall be evacuated from the area of transfer.

1910.120(j)(5)(ii)
Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

1910.120(j)(5)(iii)
An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.

1910.120(j)(5)(iv)
Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and both the site safety and health supervisor and the command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.

1910.120(j)(5)(v)
Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

1910.120(j)(5)(vi)
Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

Caution: Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Employers and their shippers should refer to 49 CFR 173.21 and 173.50.

1910.120(j)(6)
Laboratory waste packs. In addition to the requirements of paragraph (j)(5) of this section, the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs):

1910.120(j)(6)(i)
Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes.

1910.120(j)(6)(ii)
If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste until the contents are identified.

1910.120(j)(7)
Sampling of drum and container contents. Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.
1910.120(j)(8)
Shipping and transport.

1910.120(j)(8)(i)
Drums and containers shall be identified and classified prior to packaging for shipment.

1910.120(j)(8)(ii)
Drum or container staging areas shall be kept to the minimum number necessary to safely identify and classify materials and prepare them for transport.

1910.120(j)(8)(iii)
Staging areas shall be provided with adequate access and egress routes.

1910.120(j)(8)(iv)
Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.

1910.120(j)(9)
Tank and vault procedures.

1910.120(j)(9)(i)
Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

1910.120(j)(9)(ii)
Appropriate tank or vault entry procedures as described in the employer's safety and health plan shall be followed whenever employees must enter a tank or vault.

1910.120(k)
Decontamination --

1910.120(k)(1)
General. Procedures for all phases of decontamination shall be developed and implemented in accordance with this paragraph.
..1910.120(k)(2)

1910.120(k)(2)
Decontamination procedures.

1910.120(k)(2)(i)
A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

1910.120(k)(2)(ii)
Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

1910.120(k)(2)(iii)
All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

1910.120(k)(2)(iv)
Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

1910.120(k)(3)
Location. Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

1910.120(k)(4)
Equipment and solvents. All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

1910.120(k)(5)
Personal protective clothing and equipment.

1910.120(k)(5)(i)
Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

1910.120(k)(5)(ii)
Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

1910.120(k)(6)
Unauthorized employees. Unauthorized employees shall not remove protective clothing or equipment from change rooms.

1910.120(k)(7)
Commercial laundries or cleaning establishments. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

1910.120(k)(8)
Showers and change rooms. Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of 29 CFR 1910.141. If temperature conditions prevent the effective use of water, then other effective means for cleansing shall be provided and used.

1910.120(l)
Emergency response by employees at uncontrolled hazardous waste sites --

1910.120(l)(1)
Emergency response plan.

1910.120(l)(1)(i)
An emergency response plan shall be developed and implemented by all employers within the scope of paragraphs (a)(1)(i) through (ii) of this section to handle anticipated emergencies prior to the commencement of hazardous waste operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, OSHA personnel and other governmental agencies with relevant responsibilities.

1910.120(l)(1)(ii)
Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan complying with 29 CFR 1910.38.

1910.120(l)(2)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following:

1910.120(l)(2)(i)
Pre-emergency planning.

1910.120(l)(2)(ii)
Personnel roles, lines of authority, training, and communication.

1910.120(l)(2)(iii)
Emergency recognition and prevention.

1910.120(l)(2)(iv)
Safe distances and places of refuge.

1910.120(l)(2)(v)
Site security and control.

1910.120(l)(2)(vi)
Evacuation routes and procedures.
..1910.120(l)(2)(vii)

1910.120(l)(2)(vii)
Decontamination procedures which are not covered by the site safety and health plan.

1910.120(l)(2)(viii)
Emergency medical treatment and first aid.

1910.120(l)(2)(ix)
Emergency alerting and response procedures.

1910.120(l)(2)(x)
Critique of response and follow-up.

1910.120(l)(2)(xi)
PPE and emergency equipment.

1910.120(l)(3)
Procedures for handling emergency incidents.

1910.120(l)(3)(i)
In addition to the elements for the emergency response plan required in paragraph (l)(2) of this section, the following elements shall be included for emergency response plans:

1910.120(l)(3)(i)(A)
Site topography, layout, and prevailing weather conditions.

1910.120(l)(3)(i)(B)
Procedures for reporting incidents to local, state, and federal governmental agencies.

1910.120(l)(3)(ii)
The emergency response plan shall be a separate section of the Site Safety and Health Plan.

1910.120(l)(3)(iii)
The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

1910.120(l)(3)(iv)
The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

1910.120(l)(3)(v)
The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

1910.120(l)(3)(vi)
An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication, and to begin emergency procedures.

1910.120(l)(3)(vii)
Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

1910.120(m)
Illumination. Areas accessible to employees shall be lighted to not less than the minimum illumination intensities listed in the following Table H-120.1 while any work is in progress:

TABLE H-120.1. -- MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-candles	Area or operations
5	General site areas.
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas; (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.
30	First aid stations, infirmaries, and offices.

1910.120(n)
Sanitation at temporary workplaces --

1910.120(n)(1)
Potable water.

1910.120(n)(1)(i)
An adequate supply of potable water shall be provided on the site.

1910.120(n)(1)(ii)
Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

1910.120(n)(1)(iii)
Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

1910.120(n)(1)(iv)
Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

1910.120(n)(2)
Nonpotable water.

1910.120(n)(2)(i)
Outlets for nonpotable water, such as water for firefighting purposes shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

1910.120(n)(2)(ii)
There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water. ..1910.120(n)(3)

1910.120(n)(3)
Toilet facilities.

1910.120(n)(3)(i)
Toilets shall be provided for employees according to Table H-120.2.

TABLE H-120.2. -- **TOILET FACILITIES**

Number of employees	Minimum number of facilities
20 or fewer	One.
More than 20, fewer than 200	One toilet seat and 1 urinal per 40 employees.
More than 200	One toilet seat and 1 urinal per 50 employees.

1910.120(n)(3)(ii)
Under temporary field conditions, provisions shall be made to assure not less than one toilet facility is available.

1910.120(n)(3)(iii)
Hazardous waste sites, not provided with a sanitary sewer, shall be provided with the following toilet facilities unless prohibited by local codes:

1910.120(n)(3)(iii)(A)
Chemical toilets;

1910.120(n)(3)(iii)(B)
Recirculating toilets;

1910.120(n)(3)(iii)(C)
Combustion toilets; or

1910.120(n)(3)(iii)(D)
Flush toilets.

1910.120(n)(3)(iv)
The requirements of this paragraph for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

1910.120(n)(3)(v)
Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.
..1910.120(n)(4)

1910.120(n)(4)
Food handling. All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

1910.120(n)(5)
Temporary sleeping quarters. When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

1910.120(n)(6)
Washing facilities. The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below permissible exposure limits and which are under the controls of the employer; and shall be so equipped as to enable employees to remove hazardous substances from themselves.

1910.120(n)(7)
Showers and change rooms. When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.

1910.120(n)(7)(i)
Showers shall be provided and shall meet the requirements of 29 CFR 1910.141(d)(3).

1910.120(n)(7)(ii)
Change rooms shall be provided and shall meet the requirements of 29 CFR 1910.141(e). Change rooms shall consist of two separate change areas separated by the shower area required in paragraph (n)(7)(i) of this section. One change area, with an exit leading off the worksite, shall provide employees with an area where they can put on, remove and store work clothing and personal protective equipment.

1910.120(n)(7)(iii)
Showers and change rooms shall be located in areas where exposures are below the permissible exposure limits and published exposure levels. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the permissible exposure limits and published exposure levels.

1910.120(n)(7)(iv)
Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.

1910.120(o)
New technology programs.

1910.120(o)(1)
The employer shall develop and implement procedures for the introduction of effective new technologies and equipment developed for the improved protection of employees working with hazardous waste clean-up operations, and the same shall be implemented as part of the site safety and health program to assure that employee protection is being maintained.

1910.120(o)(2)
New technologies, equipment or control measures available to the industry, such as the use of foams, absorbents, absorbents, neutralizers, or other means to suppress the level of air contaminants while excavating the site or for spill control, shall be evaluated by employers or their representatives. Such an evaluation shall be done to determine the effectiveness of the new methods, materials, or equipment before implementing their use on a large scale for enhancing employee protection. Information and data from manufacturers or suppliers may be used as part of the employer's evaluation effort. Such evaluations shall be made available to OSHA upon request.

1910.120(p)
Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA). Employers conducting operations at treatment, storage and disposal (TSD) facilities specified in paragraph (a)(1)(iv) of this section shall provide and implement the programs specified in this paragraph. See the "Notes and Exceptions" to paragraph (a)(2)(iii) of this section for employers not covered.

1910.120(p)(1)
Safety and health program. The employer shall develop and implement a written safety and health program for employees involved in hazardous waste operations that shall be available for inspection by employees, their representatives and OSHA personnel. The program shall be designed to identify, evaluate and control safety and health hazards in their facilities for the purpose of employee protection, to provide for emergency response meeting the requirements of paragraph (p)(8) of this section and to address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures and uses of new technologies.

1910.120(p)(2)
Hazard communication program. The employer shall implement a hazard communication program meeting the requirements of 29 CFR 1910.1200 as part of the employer's safety and program.

NOTE TO §1910.120 - The exemption for hazardous waste provided in 1910.1200 is applicable to this section.
..1910.120(p)(3)

1910.120(p)(3)
Medical surveillance program. The employer shall develop and implement a medical surveillance program meeting the requirements of paragraph (f) of this section.

1910.120(p)(4)
Decontamination program. The employer shall develop and implement a decontamination procedure meeting the requirements of paragraph (k) of this section.

1910.120(p)(5)
New technology program. The employer shall develop and implement procedures meeting the requirements of paragraph (o) of this section for introducing new and innovative equipment into the workplace.

1910.120(p)(6)
Material handling program. Where employees will be handling drums or containers, the employer shall develop and implement procedures meeting the requirements of paragraphs (j)(1)(ii) through (viii) and (xi) of this section, as well as (j)(3) and (j)(8) of this section prior to starting such work.

1910.120(p)(7)
Training program --

1910.120(p)(7)(i)
New employees. The employer shall develop and implement a training program which is part of the employer's safety and health program, for employees exposed to health hazards or hazardous substances at TSD operations to enable the employees to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually. Employees who have received the initial training required by this paragraph shall be given a written certificate attesting that they have successfully completed the necessary training.

1910.120(p)(7)(ii)
Current employees. Employers who can show by an employee's previous work experience and/or training that the employee has had training equivalent to the initial training required by this paragraph, shall be considered as meeting the initial training requirements of this paragraph as to that employee. Equivalent training includes the training that existing employees might have already received from actual site work experience. Current employees shall receive eight hours of refresher training annually.

1910.120(p)(7)(iii)
Trainers. Trainers who teach initial training shall have satisfactorily completed a training course for teaching the subjects they are expected to teach or they shall have the academic credentials and instruction experience necessary to demonstrate a good command of the subject matter of the courses and competent instructional skills.

1910.120(p)(8)
Emergency response program --

1910.120(p)(8)(i)
Emergency response plan. An emergency response plan shall be developed and implemented by all employers. Such plans need not duplicate any of the subjects fully addressed in the employer's contingency planning required by permits, such as those issued by the U.S. Environmental Protection Agency, provided that the contingency plan is made part of the emergency response plan. The emergency response plan shall be a written portion of the employer's safety and health program required in paragraph (p)(1) of this section. Employers who will evacuate their employees from the worksite location when an emergency occurs and who do not permit any of their employees to assist in handling the emergency are exempt from the requirements of paragraph (p)(8) if they provide an emergency action plan complying with 29 CFR 1910.38.

1910.120(p)(8)(ii)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this paragraph:

1910.120(p)(8)(ii)(A)
Pre-emergency planning and coordination with outside parties.

1910.120(p)(8)(ii)(B)
Personnel roles, lines of authority, training, and communication.

1910.120(p)(8)(ii)(C)
Emergency recognition and prevention.

1910.120(p)(8)(ii)(D)
Safe distances and places of refuge.

1910.120(p)(8)(ii)(E)
Site security and control.

1910.120(p)(8)(ii)(F)
Evacuation routes and procedures.

1910.120(p)(8)(ii)(G)
Decontamination procedures.

1910.120(p)(8)(ii)(H)
Emergency medical treatment and first aid.

1910.120(p)(8)(ii)(I)
Emergency alerting and response procedures.
..1910.120(p)(8)(ii)(J)

1910.120(p)(8)(ii)(J)
Critique of response and follow-up.

1910.120(p)(8)(ii)(K)
PPE and emergency equipment.

1910.120(p)(8)(iii)
Training.

1910.120(p)(8)(iii)(A)
Training for emergency response employees shall be completed before they are called upon to perform in real emergencies. Such training shall include the elements of the emergency response plan, standard operating procedures the employer has established for the job, the personal protective equipment to be worn and procedures for handling emergency incidents.

Exception #1: an employer need not train all employees to the degree specified if the employer divides the work force in a manner such that a sufficient number of employees who have responsibility to control emergencies have the training specified, and all other employees, who may first respond to an emergency incident, have sufficient awareness training to recognize that an emergency response situation exists and that they are instructed in that case to summon the fully trained employees and not attempt control activities for which they are not trained.

Exception #2: An employer need not train all employees to the degree specified if arrangements have been made in advance for an outside fully-trained emergency response team to respond in a reasonable period and all employees, who may come to the incident first, have sufficient awareness training to recognize that an emergency response situation exists and they have been instructed to call the designated outside fully-trained emergency response team for assistance.

1910.120(p)(8)(iii)(B)
Employee members of TSD facility emergency response organizations shall be trained to a level of competence in the recognition of health and safety hazards to protect themselves and other employees. This would include training in the methods used to minimize the risk from safety and health hazards; in the safe use of control equipment; in the selection and use of appropriate personal protective equipment; in the safe operating procedures to be used at the incident scene; in the techniques of coordination with other employees to minimize risks; in the appropriate response to over exposure from health hazards or injury to themselves and other employees; and in the recognition of subsequent symptoms which may result from over exposures.

1910.120(p)(8)(iii)(C)
The employer shall certify that each covered employee has attended and successfully completed the training required in paragraph (p)(8)(iii) of this section, or shall certify the employee's competency for certification of training shall be recorded and maintained by the employer.

1910.120(p)(8)(iv)
Procedures for handling emergency incidents.

1910.120(p)(8)(iv)(A)
In addition to the elements for the emergency response plan required in paragraph (p)(8)(ii) of this section, the following elements shall be included for emergency response plans to the extent that they do not repeat any information already contained in the emergency response plan:

1910.120(p)(8)(iv)(A)(1)
Site topography, layout, and prevailing weather conditions.

1910.120(p)(8)(iv)(A)(2)
Procedures for reporting incidents to local, state, and federal governmental agencies.

1910.120(p)(8)(iv)(B)
The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

1910.120(p)(8)(iv)(C)
The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

1910.120(p)(8)(iv)(D)
The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.
..1910.120(p)(8)(iv)(E)

1910.120(p)(8)(iv)(E)
An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication; and to begin emergency procedures.

1910.120(p)(8)(iv)(F)
Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

1910.120(q)
Emergency response program to hazardous substance releases. This paragraph covers employers whose employees are engaged in emergency response no matter where it occurs except that it does not cover employees engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section. Those emergency response organizations who have developed and implemented programs equivalent to this paragraph for handling releases of hazardous substances pursuant to section 303 of the Superfund Amendments and Reauthorization Act of 1986 (Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. 11003) shall be deemed to have met the requirements of this paragraph.

1910.120(q)(1)
Emergency response plan. An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives and OSHA personnel. Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan in accordance with 29 CFR 1910.38.

1910.120(q)(2)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this paragraph:

1910.120(q)(2)(i)
Pre-emergency planning and coordination with outside parties..

1910.120(q)(2)(ii)
Personnel roles, lines of authority, training, and communication.

1910.120(q)(2)(iii)
Emergency recognition and prevention.

1910.120(q)(2)(iv)
Safe distances and places of refuge.

1910.120(q)(2)(v)
Site security and control.

1910.120(q)(2)(vi)
Evacuation routes and procedures.

1910.120(q)(2)(vii)
Decontamination.

1910.120(q)(2)(viii)
Emergency medical treatment and first aid.

1910.120(q)(2)(ix)
Emergency alerting and response procedures.
..1910.120(q)(2)(x) 1910.120(q)(2)(x)
Critique of response and follow-up.

1910.120(q)(2)(xi)
PPE and emergency equipment.

1910.120(q)(2)(xii)
Emergency response organizations may use the local emergency response plan or the state emergency response plan or both, as part of their emergency response plan to avoid duplication. Those items of the emergency response plan that are being properly addressed by the SARA Title III plans may be substituted into their emergency plan or otherwise kept together for the employer and employee's use.

1910.120(q)(3)
Procedures for handling emergency response.

1910.120(q)(3)(i)
The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for each employer.

NOTE TO PARAGRAPH (q)(3)(i). - The "***senior official***" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene. As more senior officers arrive (i.e. , battalion chief, fire chief, state law enforcement official, site coordinator, etc.) the position is passed up the line of authority which has been previously established.
1910.120(q)(3)(ii)
The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies.
..1910.120(q)(3)(iii)

1910.120(q)(3)(iii)
Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29 CFR 1910.156(e) when worn while performing firefighting operations beyond the incipient stage for any incident.

1910.120(q)(3)(iv)
Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

1910.120(q)(3)(v)
The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

1910.120(q)(3)(vi)
Back-up personnel shall be standing by with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation capability.

1910.120(q)(3)(vii)
The individual in charge of the ICS shall designate a safety officer, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

1910.120(q)(3)(viii)
When activities are judged by the safety officer to be an IDLH and/or to involve an imminent danger condition, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene.

1910.120(q)(3)(ix)
After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.
1910.120(q)(3)(x)
When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.

1910.120(q)(4)
Skilled support personnel. Personnel, not necessarily an employer's own employees, who are skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment or crane and hoisting equipment, and who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may be exposed to the hazards at an emergency response scene, are not required to meet the training required in this paragraph for the employer's regular employees. However, these personnel shall be given an initial briefing at the site prior to their participation in any emergency response. The initial briefing shall include instruction in the wearing of appropriate personal protective equipment, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety and health precautions provided to the employer's own employees shall be used to assure the safety and health of these personnel.

1910.120(q)(5)
Specialist employees. Employees who, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge, shall receive training or demonstrate competency in the area of their specialization annually.

1910.120(q)(6)
Training. Training shall be based on the duties and function to be performed by each responder of an emergency response organization. The skill and knowledge levels required for all new responders, those hired after the effective date of this standard, shall be conveyed to them through training before they are permitted to take part in actual emergency operations on an incident. Employees who participate, or are expected to participate, in emergency response, shall be given training in accordance with the following paragraphs:

1910.120(q)(6)(i)
First responder awareness level. First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond notifying the authorities of the release. First responders at the awareness level shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:
..1910.120(q)(6)(i)(A)

1910.120(q)(6)(i)(A)
An understanding of what hazardous substances are, and the risks associated with them in an incident.

1910.120(q)(6)(i)(B)
An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.

1910.120(q)(6)(i)(C)
The ability to recognize the presence of hazardous substances in an emergency.

1910.120(q)(6)(i)(D)
The ability to identify the hazardous substances, if possible.

1910.120(q)(6)(i)(E)
An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.

1910.120(q)(6)(i)(F)
The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.

1910.120(q)(6)(ii)
First responder operations level. First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

1910.120(q)(6)(ii)(A)
Knowledge of the basic hazard and risk assessment techniques.

1910.120(q)(6)(ii)(B)
Know how to select and use proper personal protective equipment provided to the first responder operational level.

1910.120(q)(6)(ii)(C)
An understanding of basic hazardous materials terms.

1910.120(q)(6)(ii)(D)
Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.

1910.120(q)(6)(ii)(E)
Know how to implement basic decontamination procedures.

1910.120(q)(6)(ii)(F)
An understanding of the relevant standard operating procedures and termination procedures.
..1910.120(q)(6)(iii)

1910.120(q)(6)(iii)
Hazardous materials technician. Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance. Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

1910.120(q)(6)(iii)(A)
Know how to implement the employer's emergency response plan.

1910.120(q)(6)(iii)(B)
Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.

1910.120(q)(6)(iii)(C)
Be able to function within an assigned role in the Incident Command System.

1910.120(q)(6)(iii)(D)
Know how to select and use proper specialized chemical personal protective equipment provided to the hazardous materials technician.

1910.120(q)(6)(iii)(E)
Understand hazard and risk assessment techniques.

1910.120(q)(6)(iii)(F)
Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.

1910.120(q)(6)(iii)(G)
Understand and implement decontamination procedures.

1910.120(q)(6)(iii)(H)
Understand termination procedures.

1910.120(q)(6)(iii)(I)
Understand basic chemical and toxicological terminology and behavior.

1910.120(q)(6)(iv)
Hazardous materials specialist. Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician, however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with Federal, state, local and other government authorities in regards to site activities. Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

1910.120(q)(6)(iv)(A)
Know how to implement the local emergency response plan.

1910.120(q)(6)(iv)(B)
Understand classification, identification and verification of known and unknown materials by using advanced survey instruments and equipment.

1910.120(q)(6)(iv)(C)
Know the state emergency response plan.

1910.120(q)(6)(iv)(D)
Be able to select and use proper specialized chemical personal protective equipment provided to the hazardous materials specialist.

1910.120(q)(6)(iv)(E)
Understand in-depth hazard and risk techniques.

1910.120(q)(6)(iv)(F)
Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.

1910.120(q)(6)(iv)(G)
Be able to determine and implement decontamination procedures.

1910.120(q)(6)(iv)(H)
Have the ability to develop a site safety and control plan.

1910.120(q)(6)(iv)(I)
Understand chemical, radiological and toxicological terminology and behavior.

1910.120(q)(6)(v)
On scene incident commander. Incident commanders, who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

1910.120(q)(6)(v)(A)
Know and be able to implement the employer's incident command system.

1910.120(q)(6)(v)(B)
Know how to implement the employer's emergency response plan.

1910.120(q)(6)(v)(C)
Know and understand the hazards and risks associated with employees working in chemical protective clothing.

1910.120(q)(6)(v)(D)
Know how to implement the local emergency response plan.
..1910.120(q)(6)(v)(E)

1910.120(q)(6)(v)(E)
Know of the state emergency response plan and of the Federal Regional Response Team.

1910.120(q)(6)(v)(F)
Know and understand the importance of decontamination procedures.

1910.120(q)(7)
Trainers. Trainers who teach any of the above training subjects shall have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the U.S. National Fire Academy, or they shall have the training and/or academic credentials and instructional experience necessary to demonstrate competent

instructional skills and a good command of the subject matter of the courses they are to teach.

1910.120(q)(8)
Refresher training.

1910.120(q)(8)(i)
Those employees who are trained in accordance with paragraph (q)(6) of this section shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.

1910.120(q)(8)(ii)
A statement shall be made of the training or competency, and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.

1910.120(q)(9)
Medical surveillance and consultation.

1910.120(q)(9)(i)
Members of an organized and designated HAZMAT team and hazardous materials specialist shall receive a baseline physical examination and be provided with medical surveillance as required in paragraph (f) of this section.

1910.120(q)(9)(ii)
Any emergency response employees who exhibit signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident either immediately or subsequently, shall be provided with medical consultation as required in paragraph (f)(3)(ii) of this section.

1910.120(q)(10)
Chemical protective clothing. Chemical protective clothing and equipment to be used by organized and designated HAZMAT team members, or to be used by hazardous materials specialists, shall meet the requirements of paragraphs (g)(3) through (5) of this section.

1910.120(q)(11)
Post-emergency response operations. Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards and materials contaminated with them (such as contaminated soil or other elements of the natural environment) from the site of the incident, the employer conducting the clean-up shall comply with one of the following:

1910.120(q)(11)(i)
Meet all the requirements of paragraphs (b) through (o) of this section; or

1910.120(q)(11)(ii)
Where the clean-up is done on plant property using plant or workplace employees, such employees shall have completed the training requirements of the following: 29 CFR 1910.38, 1910.134, 1910.1200, and other appropriate safety and health training made necessary by the tasks they are expected to perform such as personal protective equipment and decontamination procedures.

APPENDICES TO §1910.120 - HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

NOTE: The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section. However paragraph 1910.120(g) makes mandatory in certain circumstances the use of Level A and Level B PPE protection.
[61 FR 9227, March 7, 1996; 67 FR 67964, Nov. 7, 2002]
Part Number: 1910
• Part Title: Occupational Safety and Health Standards
• Subpart: H
• Subpart Title: Hazardous Materials

• Standard Number: 1910.120 App A

• Title: Personal protective equipment test methods.

This appendix sets forth the non-mandatory examples of tests which may be used to evaluate compliance with paragraphs 1910.120(g)(4) (ii) and (iii). Other tests and other challenge agents may be used to evaluate compliance.
A. Totally-Encapsulating chemical protective suit pressure test
1.0 - Scope
1.1 This practice measures the ability of a gas tight totally-encapsulating chemical protective suit material, seams, and closures to maintain a fixed positive pressure. The results of this practice allow the gas tight integrity of a total-encapsulating chemical protective suit to be evaluated.
1.2 Resistance of the suit materials to permeation, penetration, and degradation by specific hazardous substances is not determined by this test method.
2.0 - Description of Terms
2.1 "Totally-encapsulated chemical protective suit (TECP suit)" means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves and boots.
2.2 "Protective clothing material" means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.
2.3 "Gas tight" means, for the purpose of the test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.
3.0 - Summary of test method
3.1 The TECP suit is visually inspected and modified for the test. The test apparatus is attached to the suit to permit inflation to the pre-test suit expansion pressure for removal of suit wrinkles and creases. The pressure is lowered to the test pressure and monitored for three minutes. If the pressure drop is excessive, the TECP suit fails the test and is removed from service. The test is repeated after leak location and repair.
4.0 - Required Supplies
4.1 Source of compressed air.
4.2 Test apparatus for suit testing including a pressure measurement device with a sensitivity of at least 1/4 inch water gauge.
4.3 Vent valve closure plugs or sealing tape.

4.4 Soapy water solution and soft brush.
4.5 Stop watch or appropriate timing device.
5.0 - Safety Precautions
5.1 Care shall be taken to provide the correct pressure safety devices required for the source of compressed air used.
6.0 - Test Procedure
6.1 Prior to each test, the tester shall perform a visual inspection of the suit. Check the suit for seam integrity by visually examining the seams and gently pulling on the seams. Ensure that all air supply lines, fittings, visor, zippers, and valves are secure and show no signs of deterioration.
6.1.1 Seal off the vent valves along with any other normal inlet or exhaust points (such as umbilical air line fittings or face piece opening) with tape or other appropriate means (caps, plugs, fixture, etc.). Care should be exercised in the sealing process not to damage any of the suit components.
6.1.2 Close all closure assemblies.
6.1.3 Prepare the suit for inflation by providing an improvised connection point on the suit for connecting an airline. Attach the pressure test apparatus to the suit to permit suit inflation from a compressed air source equipped with a pressure indicating regulator. The leak tightness of the pressure test apparatus should be tested before and after each test by closing off the end of the tubing attached to the suit and assuring a pressure of three inches water gauge for three minutes can be maintained. If a component is removed for the test, that component shall be replaced and a second test conducted with another component removed to permit a complete tests of the ensemble.
6.1.4 The pre-test expansion pressure (A) and the suit test pressure (B) shall be supplied by the suit manufacturer, but in no case shall they be less than: (A) = 3 inches water gauge and (B) = 2 inches water gauge. The ending suit pressure (C) shall be no less than 80 percent of the test pressure (B); i.e., the pressure drop shall not exceed 20 percent of the test pressure (B).
6.1.5 Inflate the suit until the pressure inside is equal to pressure (A), the pre-test expansion suit pressure. Allow at least one minute to fill out the wrinkles in the suit. Release sufficient air to reduce the suit pressure to pressure (B), the suit test pressure. Begin timing. At the end of three minutes, record the suit pressure as pressure (C), the ending suit pressure. The difference between the suit test pressure and the ending suit test pressure (B - C) shall be defined as the suit pressure drop.
6.1.6 If the suit pressure drop is more than 20 percent of the suit test pressure (B) during the three minute test period, the suit fails the test and shall be removed from service.
7.0 - Retest Procedure
7.1 If the suit fails the test check for leaks by inflating the suit to pressure (A) and brushing or wiping the entire suit (including seams, closures, lens gaskets, glove-to-sleeve joints, etc.) with a mild soap and water solution. Observe the suit for the formation of soap bubbles, which is an indication of a leak. Repair all identified leaks.
7.2 Retest the TECP suit as outlined in Test procedure 6.0.
8.0 - Report
8.1 Each TECP suit tested by this practice shall have the following information recorded.
8.1.1 Unique identification number, identifying brand name, date of purchase, material of construction, and unique fit features; e.g., special breathing apparatus.
8.1.2 The actual values for test pressures,(A), (B), and (C) shall be recorded along with the specific observation times. If the ending pressure (C) is less than 80 percent of the test pressure (B), the suit shall be identified as failing the test. When possible, the specific leak location shall be identified in the test records. Retest pressure data shall be recorded as an additional test.

8.1.3 The source of the test apparatus used shall be identified and the sensitivity of the pressure gauge shall be recorded.
8.1.4 Records shall be kept for each pressure test even if repairs are being made at the test location.

Caution
Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.
Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.
B. Totally-encapsulated chemical protective suit qualitative leak test

1.0 - Scope
1.1 This practice semi-qualitatively tests gas tight totally-encapsulating chemical protective suit integrity by detecting inward leakage of ammonia vapor. Since no modifications are made to the suit to carry out this test, the results from this practice provide a realistic test for the integrity of the entire suit.
1.2 Resistance of the suit materials to permeation, penetration, and degradation is not determined by this test method. ASTM test methods are available to test suit materials for these characteristics and the tests are usually conducted by the manufacturers of the suits.
2.0 - Description of Terms
2.1 "Totally-encapsulated chemical protective suit (TECP suit)" means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves, and boots.
2.2 "Protective clothing material" means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with a potentially hazardous liquid or gaseous chemicals.
2.3 "Gas tight" means, for the purpose of this practice the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.
2.4 "Intrusion Coefficient" means a number expressing the level of protection provided by a gas tight totally-encapsulating chemical protective suit. The intrusion coefficient is calculated by dividing the test room challenge agent concentration by the concentration of challenge agent found inside the suit. The accuracy of the intrusion coefficient is dependent on the challenge agent monitoring methods. The larger the intrusion coefficient the greater the protection provided by the TECP suit.
3.0 - Summary of recommended practice
3.1 The volume of concentrated aqueous ammonia solution (ammonia hydroxide, NH(4) OH) required to generate the test atmosphere is determined using the directions outlined in 6.1. The suit is donned by a person wearing the appropriate respiratory equipment (either a self-contained breathing apparatus or a supplied air respirator) and worn inside the enclosed test room. The concentrated aqueous ammonia solution is taken by the suited individual into the test room and poured into an open plastic pan. A two-minute evaporation period is observed before the test room concentration is measured using a high range ammonia length of stain detector tube. When the ammonia vapor reaches a concentration of between 1000 and 1200 ppm, the suited individual starts a standardized exercise protocol to stress and flex the suit. After this protocol is completed the test room concentration is measured again. The suited individual exits the test room and his stand-by person measures the ammonia concentration

inside the suit using a low range ammonia length of stain detector tube or other more sensitive ammonia detector. A stand-by person is required to observe the test individual during the test procedure, aid the person in donning and doffing the TECP suit; and monitor the suit interior. The intrusion coefficient of the suit can be calculated by dividing the average test area concentration by the interior suit concentration. A colorimetric indicator strip of bromophenol blue is placed on the inside of the suit face piece lens so that the suited individual is able to detect a color change and know if the suit has a significant leak. If a color change is observed the individual should leave the test room immediately.

4.0 - Required supplies

4.1 A supply of concentrated aqueous ammonium hydroxide (58 percent by weight).

4.2 A supply of bromophenol/blue indicating paper, sensitive to 5-10 ppm ammonia or greater over a two-minute period of exposure.[pH 3.0(yellow) to pH 4.6(blue)]

4.3 A supply of high range (0.5 - 10 volume percent) and low range (5 - 700 ppm) detector tubes for ammonia and the corresponding sampling pump. More sensitive ammonia detectors can be substituted for the low range detector tubes to improve the sensitivity of this practice.

4.4 A plastic pan (PVC) at least 12":14":1" and a half pint plastic container (PVC) with tightly closing lid.

4.5 A graduated cylinder or other volumetric measuring device of at least 50 milliliters in volume with an accuracy of at least + or - 1 milliliters.

5.0 - Safety precautions

5.1 Concentrated aqueous ammonium hydroxide, NH(4)OH, is a corrosive volatile liquid requiring eye, skin, and respiratory protection. The person conducting test shall review the MSDS for aqueous ammonia.

5.2 Since the established permissible exposure limit for ammonia is 35 ppm as a 15 minute STEL, only persons wearing a positive pressure self-contained breathing apparatus or a supplied air respirator shall be in the chamber. Normally only the person wearing the total-encapsulating suit will be inside the chamber. A stand-by person shall have a positive pressure self-contained breathing apparatus, or a supplied air respirator, available to enter the test area should the suited individual need assistance.

5.3 A method to monitor the suited individual must be used during this test. Visual contact is the simplest but other methods using communication devices are acceptable.

5.4 The test room shall be large enough to allow the exercise protocol to be carried out and then to be ventilated to allow for easy exhaust of the ammonia test atmosphere after the test(s) are completed.

5.5 Individuals shall be medically screened for the use of respiratory protection and checked for allergies to ammonia before participating in this test procedure.

6.0 - Test procedure

6.1.1 Measure the test area to the nearest foot and calculate its volume in cubic feet. Multiply the test area volume by 0.2 milliliters of concentrated aqueous ammonia solution per cubic foot of test area volume to determine the approximate volume of concentrated aqueous ammonia required to generate 1000 ppm in the test area.

6.1.2 Measure this volume from the supply of concentrated ammonia and place it into a closed plastic container.

6.1.3 Place the container, several high range ammonia detector tubes, and the pump in the clean test pan and locate it near the test area entry door so that the suited individual has easy access to these supplies.

6.2.1 In a non-contaminated atmosphere, open a pre-sealed ammonia indicator strip and fasten one end of the strip to the inside of suit face shield lens where it can be seen by the wearer. Moisten the indicator strip with distilled water.

Care shall be taken not to contaminate the detector part of the indicator paper by touching it. A small piece of masking tape or equivalent should be used to attach the indicator strip to the interior of the suit face shield.

6.2.2 If problems are encountered with this method of attachment, the indicator strip can be attached to the outside of the respirator face piece being used during the test.

6.3 Don the respiratory protective device normally used with the suit, and then don the TECP suit to be tested. Check to be sure all openings which are intended to be sealed (zippers, gloves, etc.) are completely sealed. DO NOT, however, plug off any venting valves.

6.4 Step into the enclosed test room such as a closet, bathroom, or test booth, equipped with an exhaust fan. No air should be exhausted from the chamber during the test because this will dilute the ammonia challenge concentrations.

6.5 Open the container with the pre-measured volume of concentrated aqueous ammonia within the enclosed test room, and pour the liquid into the empty plastic test pan. Wait two minutes to allow for adequate volatilization of the concentrated aqueous ammonia. A small mixing fan can be used near the evaporation pan to increase the evaporation rate of ammonia solution.

6.6 After two minutes a determination of the ammonia concentration within the chamber should be made using the high range colorimetric detector tube. A concentration of 1000 ppm ammonia or greater shall be generated before the exercises are started.

6.7 To test the integrity of the suit the following four minute exercise protocol should be followed:

6.7.1 Raising the arms above the head with at least 15 raising motions completed in one minute.

6.7.2 Walking in place for one minute with at least 15 raising motions of each leg in a one-minute period.

6.7.3 Touching the toes with a least 10 complete motions of the arms from above the head to touching of the toes in a one-minute period.

6.7.4 Knee bends with at least 10 complete standing and squatting motions in a one-minute period.

6.8 If at any time during the test the colorimetric indicating paper should change colors, the test should be stopped and section 6.10 and 6.12 initiated (See 4.2).

6.9 After completion of the test exercise, the test area concentration should be measured again using the high range colorimetric detector tube.

6.10 Exit the test area.

6.11 The opening created by the suit zipper or other appropriate suit penetration should be used to determine the ammonia concentration in the suit with the low range length of stain detector tube or other ammonia monitor. The internal TECP suit air should be sampled far enough from the enclosed test area to prevent a false ammonia reading.

6.12 After completion of the measurement of the suit interior ammonia concentration the test is concluded and the suit is doffed and the respirator removed.

6.13 The ventilating fan for the test room should be turned on and allowed to run for enough time to remove the ammonia gas. The fan shall be vented to the outside of the building.

6.14 Any detectable ammonia in the suit interior (five ppm (NH(3)) or more for the length of stain detector tube) indicates the suit has failed the test. When other ammonia detectors are used a lower level of detection is possible, and it should be specified as the pass/fail criteria.

6.15 By following this test method, an intrusion coefficient of approximately 200 or more can be measured with the suit in a completely operational condition. If the coefficient is 200 or more, then the suit is suitable for emergency response and field use.

7.0 - Retest procedures

7.1 If the suit fails this test, check for leaks by following the pressure test in test A above.

7.2 Retest the TECP suit as outlined in the test procedure 6.0.

8.0 - Report

8.1 Each gas tight totally-encapsulating chemical protective suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number identifying brand name, date of purchase, material of construction, and unique suit features; e.g., special breathing apparatus.

8.1.2 General description of test room used for test.

8.1.3 Brand name and purchase date of ammonia detector strips and color change date.

8.1.4 Brand name, sampling range, and expiration date of the length of stain ammonia detector tubes. The brand name and model of the sampling pump should also be recorded. If another type of ammonia detector is used, it should be identified along with its minimum detection limit for ammonia.

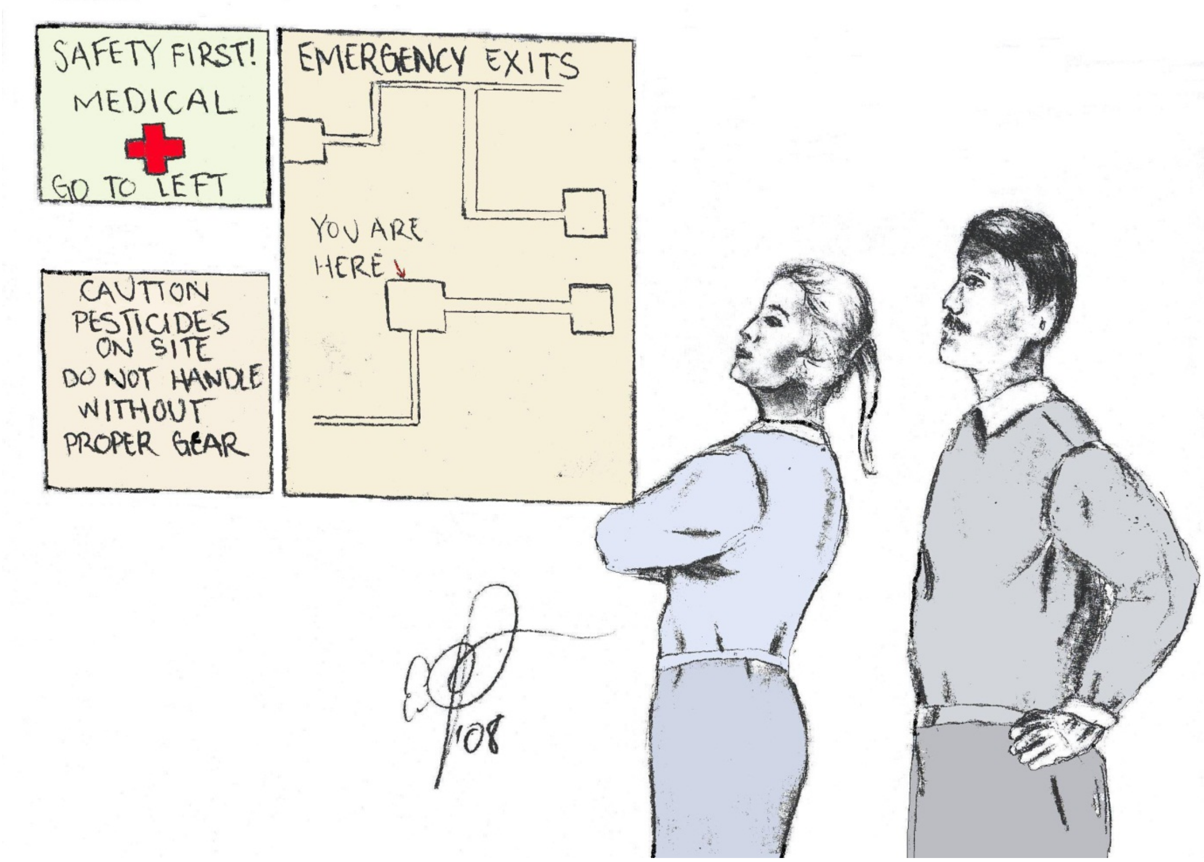
8.1.5 Actual test results shall list the two test area concentrations, their average, the interior suit concentration, and the calculated intrusion coefficient. Retest data shall be recorded as an additional test.

8.2 The evaluation of the data shall be specified as "suit passed" or "suit failed," and the date of the test. Any detectable ammonia (five ppm or greater for the length of stain detector tube) in the suit interior indicates the suit has failed this test. When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass fail criteria.

Caution

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked.

Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.



Part Number: 1910
• Part Title: Occupational Safety and Health Standards
• Subpart: H
• Subpart Title: Hazardous Materials

• Standard Number: 1910.120 App B

• Title: General description and discussion of the levels of protection and protective gear.

This appendix sets forth information about personal protective equipment (**PPE**) protection levels which may be used to assist employers in complying with the PPE requirements of this section.

As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Selection of the appropriate PPE is a complex process which should take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards; their routes of potential hazard to employees (inhalation, skin absorption, ingestion, and eye or skin contact); and the performance of the PPE materials (and seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations.(end of sentence deleted - FR 14074, Apr 13. 1990)

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, should be considered in relation to the employee's tasks . The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to up-grade or down-grade the level of PPE protection to match the tasks at hand.

The following are guidelines which an employer can use to begin the selection of the appropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A, B, C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation and re-selection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.
Part A. Personal protective equipment is divided into four categories based on the degree of protection afforded. (See Part B of this appendix for further explanation of Levels A, B, C, and D hazards.)

I. Level A - To be selected when the greatest level of skin, respiratory, and eye protection is required.
The following constitute Level A equipment; it may be used as appropriate;
1. Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.(1)
4. Long underwear.(1)
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).(1)
9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).

Footnote(1) Optional, as applicable.

II. Level B - The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.
The following constitute Level B equipment; it may be used as appropriate.
1. Positive pressure, full-facepiece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.(1)
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Boot-covers, outer, chemical-resistant (disposable).(1)
8. Hard hat.(1)
9. [Reserved]
10. Face shield.(1)

Footnote(1) Optional, as applicable.

III. Level C - The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.
The following constitute Level C equipment; it may be used as appropriate.
1. Full-face or half-mask, air purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.(1)
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant steel toe and shank.(1)
7. Boot-covers, outer, chemical-resistant (disposable).(1)
8. Hard hat.(1)
9. Escape mask.(1)
10. Face shield.(1)

Footnote(1) Optional, as applicable.

IV. Level D - A work uniform affording minimal protection: used for nuisance contamination only.
The following constitute Level D equipment; it may be used as appropriate:
1. Coveralls.
2. Gloves.(1)
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).(1)
5. Safety glasses or chemical splash goggles.(1)
6. Hard hat.(1)
7. Escape mask.(1)
8. Face shield.(1)

Footnote(1) Optional, as applicable.

Part B. The types of hazards for which levels A, B, C, and D protection are appropriate are described below:
I. Level A - Level A protection should be used when:
1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin,
2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or
3. Operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.
II. Level B protection should be used when:
1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.
2. The atmosphere contains less than 19.5 percent oxygen; or
3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin.
Note: This involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.
III. Level C - Level C protection should be used when:
1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;
2. The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and
3. All criteria for the use of air-purifying respirators are met.
IV. Level D - Level D protection should be used when:
1. The atmosphere contains no known hazard; and
2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Note: As stated before, combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

As an aid in selecting suitable chemical protective clothing, it should be noted that the National Fire Protection Association (NFPA) has developed standards on chemical protective clothing. The standards that have been adopted by include:

NFPA 1991 - Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A Protective Clothing)

NFPA 1992 - Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B Protective Clothing)

NFPA 1993 - Standard on Liquid Splash-Protective Suits for Non-emergency, Non-flammable Hazardous Chemical Situations (EPA Level B Protective Clothing)

These standards apply documentation and performance requirements to the manufacture of chemical protective suits. Chemical protective suits meeting these requirements are labeled as compliant with the appropriate standard. It is recommended that chemical protective suits that meet these standards be used.

[59 FR 43268, Aug. 22, 1994]

Part Number:1910
- **Part Title: Occupational Safety and Health Standards**
- **Subpart: H**
- **Subpart Title: Hazardous Materials**

• Standard Number: 1910.120 App C

- **Title: Compliance guidelines.**

1. Occupational Safety and Health Program. Each hazardous waste site clean-up effort will require a site specific occupational safety and health program headed by the site coordinator or the employer's representative. The purpose of the program will be the protection of employees at the site and will be an extension of the employer's overall safety and health program work. The program will need to be developed before work begins on the site and implemented as work proceeds as stated in paragraph (b). The program is to facilitate coordination and communication of safety and health issues among personnel responsible for the various activities which will take place at the site. It will provide the overall means for planning and implementing the needed safety and health training and job orientation of employees who will be working at the site. The program will provide the means for identifying and controlling worksite hazards and the means for monitoring program effectiveness. The program will need to cover the responsibilities and authority of the site coordinator for the safety and health of employees at the site, and the relationships with contractors or support services as to what each employer's safety and health responsibilities are for their employees on the site. Each contractor on the site needs to have its own safety and health program so structured that it will smoothly interface with the program of the site coordinator or principal contractor.

Also those employers involved with treating, storing or disposal of hazardous waste as covered in paragraph (p) must have implemented a safety and health program for their employees. This program is to include the hazard communication program required in paragraph (p)(1) and the training required in paragraphs (p)(7) and (p)(8) as parts of the employers comprehensive overall safety and health program. This program is to be in writing.

Each site safety and health program will need to include the following: (1) Policy statements of the line of authority and accountability for implementing the program, the objectives of the program and the role of the site safety and health officer or manager and staff; (2) means or methods for the development of procedures for identifying and controlling workplace hazards at the site; (3) means or methods for the development and communication to employees of the various plans, work rules, standard operating procedures and practices that pertain to individual employees and supervisors; (4) means for the training of supervisors and employees to develop the needed skills and knowledge to perform their work in a safe and healthful manner; (5) means to anticipate and prepare for emergency situations and; (6) means for obtaining information feedback to aid in evaluating the program and for improving the effectiveness of the program. The management and employees should be trying continually to improve the effectiveness of the program thereby enhancing the protection being afforded those working on the site.

Accidents on the site or workplace should be investigated to provide information on how such occurrences can be avoided in the future. When injuries or illnesses occur on the site or workplace, they will need to be investigated to determine what needs to be done to prevent this incident from occurring again. Such information will need to be used as feedback on the effectiveness of the program and the information turned into positive steps to prevent any reoccurrence.

Receipt of employee suggestions or complaints relating to safety and health issues involved with site activities is also a feedback mechanism that can be used effectively to improve the program and may serve in part as an evaluative tool(s).

For the development and implementation of the program to be the most effective, professional safety and health personnel should be used. Certified Safety Professionals, Board Certified Industrial Hygienists or Registered Professional Safety Engineers are good examples of professional stature for safety and health managers who will administer the employer's program.

2. Training. The training programs for employees subject to the requirements of paragraph (e) of this standard should address: the safety and health hazards employees should expect to find on hazardous waste clean-up sites; what control measures or techniques are effective for those hazards; what monitoring procedures are effective in characterizing exposure levels; what makes an effective employer's safety and health program; what a site safety and health plan should include; hands on training with personal protective equipment and clothing they may be expected to use; the contents of the OSHA standard relevant to the employee's duties and function; and employee's responsibilities under OSHA and other regulations. Supervisors will need training in their responsibilities under the safety and health program and its subject areas such as the spill containment program, the personal protective equipment program, the medical surveillance program, the emergency response plan and other areas.

The training programs for employees subject to the requirements of paragraph (p) of this standard should address: the employer's safety and health program elements impacting employees; the hazard communication program; the hazards and the controls for such hazards that employees need to know for their job duties and functions. All require annual refresher training.

The training programs for employees covered by the requirements of paragraph (q) of this standard should address those competencies required for the various levels of response such as: the hazards associated with hazardous substances; hazard identification and awareness; notification of appropriate persons; the need for and use of personal protective equipment including respirators; the decontamination procedures to be used; preplanning activities for hazardous substance incidents including the emergency response plan; company standard operating procedures for hazardous substance emergency responses; the use of the incident command system and other subjects. Hands-on training should be stressed whenever possible. Critiques done after an incident which include an evaluation of what worked and what did not and how could the incident be better handled the next time may be counted as training time.

For hazardous materials specialists (usually members of hazardous materials teams), the training should address the care, use and/or testing of chemical protective clothing including totally encapsulating suits, the medical surveillance program, the standard operating procedures for the hazardous materials team including the use of plugging and patching equipment and other subject areas.

Officers and leaders who may be expected to be in charge at an incident should be fully knowledgeable of their company's incident command system. They should know where and how to obtain additional assistance and be familiar with the local district's emergency response plan and the state emergency response plan.

Specialist employees such as technical experts, medical experts or environmental experts that work with hazardous materials in their regular jobs, who may be sent to the incident scene by the shipper, manufacturer or governmental agency to advise and assist the person in charge of the incident should have training on an annual basis. Their training should include the care and use of personal protective equipment including respirators; knowledge of the incident command system and how they are to relate to it; and those areas needed to

keep them current in their respective field as it relates to safety and health involving specific hazardous substances.
Those skilled support personnel, such as employees who work for public works departments or equipment operators who operate bulldozers, sand trucks, backhoes, etc., who may be called to the incident scene to provide emergency support assistance, should have at least a safety and health briefing before entering the area of potential or actual exposure. These skilled support personnel, who have not been a part of the emergency response plan and do not meet the training requirements, should be made aware of the hazards they face and should be provided all necessary protective clothing and equipment required for their tasks.

There are two National Fire Protection Association standards. NFPA 472 - "Standard for Professional Competence of Responders to Hazardous Material Incidents" and NFPA 471 - "Recommended Practice for Responding to Hazardous Material Incidents", which are excellent resource documents to aid fire departments and other emergency response organizations in developing their training program materials. NFPA 472 provides guidance on the skills and knowledge needed for first responder awareness level, first responder operations level, hazmat technicians, and hazmat specialist. It also offers guidance for the officer corp who will be in charge of hazardous substance incidents.

3. Decontamination. Decontamination procedures should be tailored to the specific hazards of the site and will vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method will not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to assure that employees are not exposed to hazards by reusing PPE. References in Appendix D may be used for guidance in establishing an effective decontamination program. In addition, the U.S. Coast Guard's Manual, "***Policy Guidance for Response to Hazardous Chemical Releases***," U.S. Department of Transportation, Washington, DC (COMDTINST M16465.30) is a good reference for establishing an effective decontamination program.

4. Emergency response plans. States, along with designated districts within the states, will be developing or have developed emergency response plans. These state and district plans should be utilized in the emergency response plans called for in the standard. Each employer should assure that its emergency response plan is compatible with the local plan. The major reference being used to aid in developing the state and local district plans is the Hazardous Materials Emergency Planning Guide, NRT - 1. The current Emergency Response Guidebook from the U.S. Department of Transportation, CMA's CHEMTREC and the Fire Service Emergency Management Handbook may also be used as resources.

Employers involved with treatment, storage, and disposal facilities for hazardous waste, which have the required contingency plan called for by their permit, would not need to duplicate the same planning elements. Those items of the emergency response plan may be substituted into the emergency response plan required in 1910.120 or otherwise kept together for employer and employee use.

5. Personal protective equipment programs. The purpose of personal protective clothing and equipment (**PPE**) is to shield or isolate individuals from the chemical, physical, and biologic hazards that may be encountered at a hazardous substance site.

As discussed in Appendix B, no single combination of protective equipment and clothing is capable of protecting against all hazards. Thus PPE should be used in conjunction with other protective methods and its effectiveness evaluated periodically.

The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility and communication. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. However, over-protection, as well as under-protection, can be hazardous and should be avoided where possible. Two basic objectives of any PPE program should be to protect the wearer from safety and health hazards, and to prevent injury to the wearer from incorrect use and/or malfunction of the PPE. To accomplish these goals, a comprehensive PPE program should include hazard identification, medical monitoring, environmental surveillance, selection, use, maintenance, and decontamination of PPE and its associated training.

The written PPE program should include policy statements, procedures, and guidelines. Copies should be made available to all employees, and a reference copy should be made available at the worksite. Technical data on equipment, maintenance manuals, relevant regulations, and other essential information should also be collected and maintained.

6. Incident command system (**ICS**). Paragraph 1910.120(q)(3)(ii) requires the implementation of an ICS. The ICS is an organized approach to effectively control and manage operations at an emergency incident. The individual in charge of the ICS is the senior official responding to the incident. The ICS is not much different than the "command post" approach used for many years by the fire service. During large complex fires involving several companies and many pieces of apparatus, a command post would be established. This enabled one individual to be in charge of managing the incident, rather than having several officers from different companies making separate, and sometimes conflicting, decisions. The individual in charge of the command post would delegate responsibility for performing various tasks to subordinate officers.

Additionally, all communications were routed through the command post to reduce the number of radio transmissions and eliminate confusion. However, strategy, tactics, and all decisions were made by one individual.

The ICS is a very similar system, except it is implemented for emergency response to all incidents, both large and small, that involve hazardous substances.

For a small incident, the individual in charge of the ICS may perform many tasks of the ICS. There may not be any, or little, delegation of tasks to subordinates. For example, in response to a small incident, the individual in charge of the ICS, in addition to normal command activities, may become the safety officer and may designate only one employee (with proper equipment) as a backup to provide assistance if needed. OSHA does recommend, however, that at least two employees be designated as back-up personnel since the assistance needed may include rescue.
To illustrate the operation of the ICS, the following scenario might develop during a small incident, such as an overturned tank truck with a small leak of flammable liquid.

The first responding senior officer would implement and take command of the ICS. That person would size-up the incident and determine if additional personnel and apparatus were necessary; would determine what actions to take to control the leak; and determine the proper level of personal protective equipment. If additional assistance is not needed, the individual in charge of the ICS would implement actions to stop and control the leak using the fewest number of personnel that can effectively accomplish the tasks. The individual in charge of the ICS then would designate himself as the safety officer and two other employees as a back-up in case rescue may become necessary. In this scenario, decontamination procedures would not be necessary.

A large complex incident may require many employees and difficult, time-consuming efforts to control. In these situations, the individual in charge of the ICS will want to delegate different tasks to subordinates in order to maintain a span of control that will keep the number of subordinates, that are reporting, to a manageable level.

Delegation of task at large incidents may be by location, where the incident scene is divided into sectors, and subordinate officers coordinate activities within the sector that they have been assigned.

Delegation of tasks can also be by function. Some of the functions that the individual in charge of the ICS may want to delegate at a large incident are: medical services; evacuation; water supply; resources (equipment, apparatus); media relations; safety; and, site control (integrate activities with police for crowd and traffic control). Also for a large incident, the individual in charge of the ICS will designate several employees as back-up personnel; and a number of safety officers to monitor conditions and recommend safety precautions.

Therefore, no matter what size or complexity an incident may be, by implementing an ICS there will be one individual in charge who makes the decisions and gives directions; and, all actions, and communications are coordinated through one central point of command. Such a system should reduce confusion, improve safety, organize and coordinate actions, and should facilitate effective management of the incident.

7. Site Safety and Control Plans. The safety and security of response personnel and others in the area of an emergency response incident site should be of primary concern to the incident commander. The use of a site safety and control plan could greatly assist those in charge of assuring the safety and health of employees on the site.

A comprehensive site safety and control plan should include the following: summary analysis of hazards on the site and a risk analysis of those hazards; site map or sketch; site work zones (clean zone, transition or decontamination zone, work or hot zone); use of the buddy system; site communications; command post or command center; standard operating procedures and safe work practices; medical assistance and triage area; hazard monitoring plan (air contaminate monitoring, etc.); decontamination procedures and area; and other relevant areas.

This plan should be a part of the employer's emergency response plan or an extension of it to the specific site.

8. Medical surveillance programs. Workers handling hazardous substances may be exposed to toxic chemicals, safety hazards, biologic hazards, and radiation. Therefore, a medical surveillance program is essential to assess and monitor workers' health and fitness for employment in hazardous waste operations and during the course of work; to provide emergency and other treatment as needed; and to keep accurate records for future reference.

The Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities developed by the National Institute for Occupational Safety and Health (**NIOSH**), the Occupational Safety and Health Administration (**OSHA**), the U.S. Coast Guard (**USCG**), and the Environmental Protection Agency (**EPA**); October 1985 provides an excellent example of the types of medical testing that should be done as part of a medical surveillance program.

9. New Technology and Spill Containment Programs. Where hazardous substances may be released by spilling from a container that will expose employees to the hazards of the materials, the employer will need to implement a program to contain and control the spilled material. Diking and ditching, as well as use of absorbents like diatomaceous earth, are traditional techniques which have proven to be effective over the years.

However, in recent years new products have come into the marketplace, the use of which complement and increase the effectiveness of these traditional methods. These new products also provide emergency responders and others with additional tools or agents to use to reduce the hazards of spilled materials.

These agents can be rapidly applied over a large area and can be uniformly applied or otherwise can be used to build a small dam, thus improving the workers' ability to control spilled material. These application techniques enhance the intimate contact between the agent and the spilled material allowing for the quickest effect by the agent or quickest control of the spilled material. Agents are available to solidify liquid spilled materials, to suppress vapor generation from spilled materials, and to do both. Some special agents, which when applied as recommended by the manufacturer, will react in a controlled manner with the spilled material to neutralize acids or caustics, or greatly reduce the level of hazard of the spilled material.

There are several modern methods and devices for use by emergency response personnel or others involved with spill control efforts to safely apply spill control agents to control spilled material hazards. These include portable pressurized applicators similar to hand-held portable fire extinguishing devices, and nozzle and hose systems similar to portable fire fighting foam systems which allow the operator to apply the agent without having to come into contact with the spilled material. The operator is able to apply the agent to the spilled material from a remote position.

The solidification of liquids provides for rapid containment and isolation of hazardous substance spills. By directing the agent at run-off points or at the edges of the spill, the reactant solid will automatically create a barrier to slow or stop the spread of the material.

Clean-up of hazardous substances is greatly improved when solidifying agents, acid or caustic neutralizers, or activated carbon absorbents are used. properly applied, these agents can totally solidify liquid hazardous substances or neutralize or absorb them, which results in materials which are less hazardous and easier to handle, transport, and dispose of. The concept of spill treatment, to create less hazardous substances, will improve the safety and level of protection of employees working at spill clean-up operations or emergency response operations to spills of hazardous substances.

The use of vapor suppression agents for volatile hazardous substances, such as flammable liquids and those substances, such as flammable liquids and those substances which present an inhalation hazard, is important for protecting workers. The rapid and uniform distribution of the agent over the surface of the spilled material can provide quick vapor knockdown.

There are temporary and long-term foam-type agents which are effective on vapors and dusts, and activated carbon adsorption agents which are effective for vapor control and soaking-up of the liquid. The proper use of hose lines or hand-held portable pressurized applicators provides good mobility and permits the worker to deliver the agent from a safe distance without having to step into the untreated spilled material.

Some of these systems can be recharged in the field to provide coverage of larger spill areas than the design limits of a single charged applicator unit. Some of the more effective agents can solidify the liquid flammable hazardous substances and at the same time elevate the flashpoint above 140 degrees F so the resulting substance may be handled as a nonhazardous waste material if it meets the U.S. Environmental Protection Agency's 40 CFR part 261 requirements (See particularly 261.21).

All workers performing hazardous substance spill control work are expected to wear the proper protective clothing and equipment for the materials present and to follow the employer's established standard operating procedures for spill control. All involved workers need to be trained in the established operating procedures; in the use and care of spill control equipment; and in the associated hazards and control of such hazards of spill containment work.

These new tools and agents are the things that employers will want to evaluate as part of their new technology program. The treatment of spills of hazardous substances or wastes at an emergency incident as part of the immediate spill containment and control efforts is sometimes acceptable to EPA and a permit exception is described in 40 CFR 264.1(g)(8) and 265.1(c)(11).

Part Number:1910
- **Part Title: Occupational Safety and Health Standards**
- **Subpart: H**
- **Subpart Title: Hazardous Materials**

• Standard Number: 1910.120 App D

- **Title: References.**

The following references may be consulted for further information on the subject of this standard:

1. OSHA Instruction DFO CPL 2.70 - January 29, 1986, Special Emphasis Program: Hazardous Waste Sites.
2. OSHA Instruction DFO CPL 2-2.37A - January 29, 1986, Technical Assistance and Guidelines for Superfund and Other Hazardous Waste Site Activities.
3. OSHA Instruction DTS CPL 2.74 - January 29, 1986, Hazardous Waste Activity Form, OSHA 175.
4. Hazardous Waste Inspections Reference Manual, U.S. Department of Labor, Occupational Safety and Health Administration, 1986.
5. Memorandum of Understanding Among the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the United States Coast Guard, and the United States Environmental Protection Agency, Guidance for Worker Protection During Hazardous Waste Site Investigations and Clean-up and Hazardous Substance Emergencies. December 18, 1980.
6. National Priorities List, 1st Edition, October 1984; U.S. Environmental Protection Agency, Revised periodically.
7. The Decontamination of Response Personnel, Field Standard Operating Procedures (F.S.O.P.) 7; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, December 1984.
8. Preparation of a Site Safety Plan, Field Standard Operating Procedures (F.S.O.P.) 9; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, April 1985.
9. Standard Operating Safety Guidelines; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team; November 1984.
10. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and Environmental Protection Agency (EPA); October 1985.
11. Protecting Health and Safety at Hazardous Waste Sites: An Overview, U.S. Environmental Protection Agency, EPA/625/9-85/006; September 1985.
12. Hazardous Waste Sites and Hazardous Substance Emergencies, NIOSH Worker Bulletin, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; December 1982.
13. Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide; U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; October 1984.
14. Fire Service Emergency Management Handbook, Federal Emergency Management Agency, Washington, DC, January 1985.
15. Emergency Response Guidebook, U.S. Department of Transportation, Washington, DC, 1987.

16. Report to the Congress on Hazardous Materials Training. Planning and Preparedness, Federal Emergency Management Agency, Washington, DC, July 1986.
17. Workbook for Fire Command, Alan V.Brunacini and J. David Beageron, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, 1985.
18. Fire Command, Alan B. Brunacini, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, 1985.
19. Incident Command System, Fire Protection Publications, Oklahoma State University, Stillwater, OK 74078, 1983.
20. Site Emergency Response Planning, Chemical Manufacturers Association, Washington, DC 20037, 1986.
21. Hazardous Materials Emergency Planning Guide, NRT-1, Environmental Protection Agency, Washington, DC, March 1987.
22. Community Teamwork: Working Together to Promote Hazardous Materials Transportation Safety. U.S. Department of Transportation, Washington, DC, May 1983.
23. Disaster Planning Guide for Business and Industry, Federal Emergency Management Agency, Publication No. FEMA 141, August 1987.
(The Office of Management and Budget has approved the information collection requirements in this section under control number 1218-0139)

Part Number: 1910
• Part Title: Occupational Safety and Health Standards
• Subpart: H
• Subpart Title: Hazardous Materials

• Standard Number: 1910.120 App E

• Title: Training Curriculum Guidelines - (Non-mandatory)

The following non-mandatory general criteria may be used for assistance in developing site-specific training curriculum used to meet the training requirements of 29 CFR 1910.120(e); 29 CFR 1910.120(p)(7), (p)(8)(iii); and 29 CFR 1910.120(q)(6), (q)(7), and (q)(8). These are generic guidelines and they are not presented as a complete training curriculum for any specific employer. Site- specific training programs must be developed on the basis of a needs assessment of the hazardous waste site, RCRA/TSDF, or emergency response operation in accordance with 29 CFR 1910.120.

It is noted that the legal requirements are set forth in the regulatory text of Sec. 1910.120. The guidance set forth here presents a highly effective program that in the areas covered would meet or exceed the regulatory requirements. In addition, other approaches could meet the regulatory requirements.

Suggested General Criteria

Definitions:
"Competent" means possessing the skills, knowledge, experience, and judgment to perform assigned tasks or activities satisfactorily as determined by the employer.
"Demonstration" means the showing by actual use of equipment or procedures.
"Hands-on training" means training in a simulated work environment that permits each student to have experience performing tasks, making decisions, or using equipment appropriate to the job assignment for which the training is being conducted.
"Initial training" means training required prior to beginning work.
"Lecture" means an interactive discourse with a class lead by an instructor.
"Proficient" means meeting a stated level of achievement.
"Site-specific" means individual training directed to the operations of a specific job site.
"Training hours" means the number of hours devoted to lecture, learning activities, small group work sessions, demonstration, evaluations, or hands-on experience.
Suggested core criteria:

1. Training facility. The training facility should have available sufficient resources, equipment, and site locations to perform didactic and hands-on training when appropriate. Training facilities should have sufficient organization, support staff, and services to conduct training in each of the courses offered.
2. Training Director. Each training program should be under the direction of a training director who is responsible for the program. The Training Director should have a minimum of two years of employee education experience.
3. Instructors. Instructors should be deem competent on the basis of previous documented experience in their area of instruction, successful completion of a "train-the-trainer" program specific to the topics they will teach, and an evaluation of instructional competence by the Training Director.

Instructors should be required to maintain professional competency by participating in continuing education or professional development programs or by completing successfully an annual refresher course and having an annual review by the Training Director.

The annual review by the Training Director should include observation of an instructor's delivery, a review of those observations with the trainer, and an analysis of any instructor or class evaluations completed by the students during the previous year.

4. Course materials. The Training Director should approve all course materials to be used by the training provider. Course materials should be reviewed and updated at least annually. Materials and equipment should be in good working order and maintained properly.

All written and audio-visual materials in training curricula should be peer reviewed by technically competent outside reviewers or by a standing advisory committee.

Reviews should possess expertise in the following disciplines were applicable: occupational health, industrial hygiene and safety, chemical/environmental engineering, employee education, or emergency response. One or more of the peer reviewers should be an employee experienced in the work activities to which the training is directed.

5. Students. The program for accepting students should include:
a. Assurance that the student is or will be involved in work where chemical exposures are likely and that the student possesses the skills necessary to perform the work.
b. A policy on the necessary medical clearance.
6. Ratios. Student-instructor ratios should not exceed 30 students per instructor. Hands-on activity requiring the use of personal protective equipment should have the following student-instructor ratios. For Level C or Level D personal protective equipment the ratio should be 10 students per instructor. For Level A or Level B personal protective equipment the ratio should be 5 students per instructor.

7. Proficiency assessment. Proficiency should be evaluated and documented by the use of a written assessment and a skill demonstration selected and developed by the Training Director and training staff. The assessment and demonstration should evaluate the knowledge and individual skills developed in the course of training. The level of minimum achievement necessary for proficiency shall be specified in writing by the Training Director.

If a written test is used, there should be a minimum of 50 questions. If a written test is used in combination with a skills demonstration, a minimum of 25 questions should be used. If a skills demonstration is used, the tasks chosen and the means to rate successful completion should be fully documented by the Training Director.

The content of the written test or of the skill demonstration shall be relevant to the objectives of the course. The written test and skill demonstration should be updated as necessary to reflect changes in the curriculum and any update should be approved by the Training Director.

The proficiency assessment methods, regardless of the approach or combination of approaches used, should be justified, documented and approved by the Training Director.

The proficiency of those taking the additional courses for supervisors should be evaluated and documented by using proficiency assessment methods acceptable to the Training

Director. These proficiency assessment methods must reflect the additional responsibilities borne by supervisory personnel in hazardous waste operations or emergency response.

8. Course certificate. Written documentation should be provided to each student who satisfactorily completes the training course.
The documentation should include:

a. Student's name.
b. Course title.
c. Course date.
d. Statement that the student has successfully completed the course.
e. Name and address of the training provider.
f. An individual identification number for the certificate.
g. List of the levels of personal protective equipment used by the student to complete the course.

This documentation may include a certificate and an appropriate wallet-sized laminated card with a photograph of the student and the above information. When such course certificate cards are used, the individual identification number for the training certificate should be shown on the card.

9. Recordkeeping. Training providers should maintain records listing the dates courses were presented, the names of the individual course attenders, the names of those students successfully completing each course, and the number of training certificates issued to each successful student. These records should be maintained for a minimum of five years after the date an individual participated in a training program offered by the training provider. These records should be available and provided upon the student's request or as mandated by law.

10. Program quality control. The Training Director should conduct or direct an annual written audit of the training program. Program modifications to address deficiencies, if any, should be documented, approved, and implemented by the training provider. The audit and the program modification documents should be maintained at the training facility.

Suggested Program Quality Control Criteria
Factors listed here are suggested criteria for determining the quality and appropriateness of employee health and safety training for hazardous waste operations and emergency response.
A. Training Plan.
Adequacy and appropriateness of the training program's curriculum development, instructor training, distribution of course materials, and direct student training should be considered, including:
1. The duration of training, course content, and course schedules/agendas;
2. The different training requirements of the various target populations, as specified in the appropriate generic training curriculum;
3. The process for the development of curriculum, which includes appropriate technical input, outside review, evaluation, program pretesting.
4. The adequate and appropriate inclusion of hands-on, demonstration, and instruction methods;
5. Adequate monitoring of student safety, progress, and performance during the training.
B. Program management, Training Director, staff, and consultants.

Adequacy and appropriateness of staff performance and delivering an effective training program should be considered, including:
1. Demonstration of the training director's leadership in assuring quality of health and safety training.
2. Demonstration of the competency of the staff to meet the demands of delivering high quality hazardous waste employee health and safety training.
3. Organization charts establishing clear lines of authority.
4. Clearly defined staff duties including the relationship of the training staff to the overall program.
5. Evidence that the training organizational structure suits the needs of the training program.
6. Appropriateness and adequacy of the training methods used by the instructors.
7. Sufficiency of the time committed by the training director and staff to the training program.
8. Adequacy of the ratio of training staff to students.
9. Availability and commitment of the training program of adequate human and equipment resources in the areas of:
a. Health effects,
b. Safety,
c. Personal protective equipment (PPE),
d. Operational procedures,
e. Employee protection practices/procedures.
10. Appropriateness of management controls.
11. Adequacy of the organization and appropriate resources assigned to assure appropriate training.
12. In the case of multiple-site training programs, adequacy of satellite centers management.
C. Training facilities and resources.
Adequacy and appropriateness of the facilities and resources for supporting the training program should be considered, including:
1. Space and equipment to conduct the training.
2. Facilities for representative hands-on training.
3. In the case of multiple-site programs, equipment and facilities at the satellite centers.
4. Adequacy and appropriateness of the quality control and evaluations program to account for instructor performance.
5. Adequacy and appropriateness of the quality control and evaluation program to ensure appropriate course evaluation, feedback, updating, and corrective action.
6. Adequacy and appropriateness of disciplines and expertise being used within the quality control and evaluation program.
7. Adequacy and appropriateness of the role of student evaluations to provide feedback for training program improvement.
D. Quality control and evaluation.
Adequacy and appropriateness of quality control and evaluation plans for training programs should be considered, including:
1. A balanced advisory committee and/or competent outside reviewers to give overall policy guidance;
2. Clear and adequate definition of the composition and active programmatic role of the advisory committee or outside reviewers.
3. Adequacy of the minutes or reports of the advisory committee or outside reviewers' meetings or written communication.
4. Adequacy and appropriateness of the quality control and evaluations program to account for instructor performance.
5. Adequacy and appropriateness of the quality control and evaluation program to ensure appropriate course evaluation, feedback, updating, and corrective action.

6. Adequacy and appropriateness of disciplines and expertise being used within the quality control and evaluation program.
7. Adequacy and appropriateness of the role of student evaluations to provide feedback for training program improvement.
E. Students
Adequacy and appropriateness of the program for accepting students should be considered, including:
1. Assurance that the student already possess the necessary skills for their job, including necessary documentation.
2. Appropriateness of methods the program uses to ensure that recruits are capable of satisfactorily completing training.
3. Review and compliance with any medical clearance policy.
F. Institutional Environment and Administrative Support
The adequacy and appropriateness of the institutional environment and administrative support system for the training program should be considered, including:
1. Adequacy of the institutional commitment to the employee training program.
2. Adequacy and appropriateness of the administrative structure and administrative support.

G. Summary of Evaluation Questions
Key questions for evaluating the quality and appropriateness of an overall training program should include the following:
1. Are the program objectives clearly stated?
2. Is the program accomplishing its objectives?
3. Are appropriate facilities and staff available?
4. Is there an appropriate mix of classroom, demonstration, and hands-on training?
5. Is the program providing quality employee health and safety training that fully meets the intent of regulatory requirements?
6. What are the program's main strengths?
7. What are the program's main weaknesses?
8. What is recommended to improve the program?
9. Are instructors instructing according to their training outlines?
10. Is the evaluation tool current and appropriate for the program content?
11. Is the course material current and relevant to the target group?
Suggested Training Curriculum Guidelines
The following training curriculum guidelines are for those operations specifically identified in 29 CFR 1910.120 as requiring training. Issues such as qualifications of instructors, training certification, and similar criteria appropriate to all categories of operations addressed in 1910.120 have been covered in the preceding section and are not re-addressed in each of the generic guidelines. Basic core requirements for training programs that are addressed include:
1. General Hazardous Waste Operations
2. RCRA operations--Treatment, storage, and disposal facilities.
3. Emergency Response.
A. General Hazardous Waste Operations and Site-specific Training
1. Off-site training. Training course content for hazardous waste operations, required by 29 CFR 1910.120(e), should include the following topics or procedures:
a. Regulatory knowledge.
(1) An review of 29 CFR 1910.120 and the core elements of an occupational safety and health program.
(2) The content of a medical surveillance program as outlined in 29 CFR 1910.120(f).

(3) The content of an effective site safety and health plan consistent with the requirements of 29 CFR 1910.120(b) (4) (ii).
(4) Emergency response plan and procedures as outlined in 29 CFR 1910.38 and 29 CFR 1910.120(l).
(5) Adequate illumination.
(6) Sanitation recommendation and equipment.
(7) Review and explanation of OSHA's hazard-communication standard (29 CFR 1910.1200) and lock-out-tag-out standard (29 CFR 1910.147).
(8) Review of other applicable standards including but not limited to those in the construction standards (29 CFR Part 1926).
(9) Rights and responsibilities of employers and employees under applicable OSHA and EPA laws.
b. Technical knowledge.
(1) Type of potential exposures to chemical, biological, and radiological hazards; types of human responses to these hazards and recognition of those responses; principles of toxicology and information about acute and chronic hazards; health and safety considerations of new technology.
(2) Fundamentals of chemical hazards including but not limited to vapor pressure, boiling points, flash points, ph, other physical and chemical properties.
(3) Fire and explosion hazards of chemicals.
(4) General safety hazards such as but not limited to electrical hazards, powered equipment hazards, motor vehicle hazards, walking- working surface hazards, excavation hazards, and hazards associated with working in hot and cold temperature extremes.
(5) Review and knowledge of confined space entry procedures in 29 CFR 1910.146.
(6) Work practices to minimize employee risk from site hazards.
(7) Safe use of engineering controls, equipment, and any new relevant safety technology or safety procedures.
(8) Review and demonstration of competency with air sampling and monitoring equipment that may be used in a site monitoring program.
(9) Container sampling procedures and safeguarding; general drum and container handling procedures including special requirement for laboratory waste packs, shock-sensitive wastes, and radioactive wastes.
(10) The elements of a spill control program.
(11) Proper use and limitations of material handling equipment.
(12) Procedures for safe and healthful preparation of containers for shipping and transport.
(13) Methods of communication including those used while wearing respiratory protection.
c. Technical skills.
(1) Selection, use maintenance, and limitations of personal protective equipment including the components and procedures for carrying out a respirator program to comply with 29 CFR 1910.134.
(2) Instruction in decontamination programs including personnel, equipment, and hardware; hands-on training including level A, B, and C ensembles and appropriate decontamination lines; field activities including the donning and doffing of protective equipment to a level commensurate with the employee's anticipated job function and responsibility and to the degree required by potential hazards.
(3) Sources for additional hazard information; exercises using relevant manuals and hazard coding systems.
d. Additional suggested items.
(1) A laminated, dated card or certificate with photo, denoting limitations and level of protection for which the employee is trained should be issued to those students successfully completing a course.

(2) Attendance should be required at all training modules, with successful completion of exercises and a final written or oral examination with at least 50 questions.
(3) A minimum of one-third of the program should be devoted to hands-on exercises.
(4) A curriculum should be established for the 8-hour refresher training required by 29 CFR 1910.120(e) (8), with delivery of such courses directed toward those areas of previous training that need improvement or reemphasis.
(5) A curriculum should be established for the required 8-hour training for supervisors. Demonstrated competency in the skills and knowledge provided in a 40-hour course should be a prerequisite for supervisor training.
2. Refresher training.
The 8-hour annual refresher training required in 29 CFR 1910.120(e) (8) should be conducted by qualified training providers. Refresher training should include at a minimum the following topics and procedures:
(a) Review of and retraining on relevant topics covered in the 40-hour program, as appropriate, using reports by the students on their work experiences.
(b) Update on developments with respect to material covered in the 40-hour course.
(c) Review of changes to pertinent provisions of EPA or OSHA standards or laws.
(d) Introduction of additional subject areas as appropriate.
(e) Hands-on review of new or altered PPE or decontamination equipment or procedures. Review of new developments in personal protective equipment.
(f) Review of newly developed air and contaminant monitoring equipment.
3. On-site training.
a. The employer should provide employees engaged in hazardous waste site activities with information and training prior to initial assignment into their work area, as follows:
(1) The requirements of the hazard communication program including the location and availability of the written program, required lists of hazardous chemicals, and material safety data sheets.
(2) Activities and locations in their work area where hazardous substance may be present.
(3) Methods and observations that may be used to detect the present or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearances, or other evidence (sight, sound or smell) of hazardous chemicals being released, and applicable alarms from monitoring devices that record chemical releases.
(4) The physical and health hazards of substances known or potentially present in the work area.
(5) The measures employees can take to help protect themselves from work-site hazards, including specific procedures the employer has implemented.
(6) An explanation of the labeling system and material safety data sheets and how employees can obtain and use appropriate hazard information.
(7) The elements of the confined space program including special PPE, permits, monitoring requirements, communication procedures, emergency response, and applicable lock-out procedures.
b. The employer should provide hazardous waste employees information and training and should provide a review and access to the site safety and plan as follows:
(1) Names of personnel and alternate responsible for site safety and health.
(2) Safety and health hazards present on the site.
(3) Selection, use, maintenance, and limitations of personal protective equipment specific to the site.
(4) Work practices by which the employee can minimize risks from hazards.
(5) Safe use of engineering controls and equipment available on site.

(6) Safe decontamination procedures established to minimize employee contact with hazardous substances, including:
(A) Employee decontamination,
(B) Clothing decontamination, and
(C) Equipment decontamination.
(7) Elements of the site emergency response plan, including:
(A) Pre-emergency planning.
(B) Personnel roles and lines of authority and communication.
(C) Emergency recognition and prevention.
(D) Safe distances and places of refuge.
(E) Site security and control.
(F) Evacuation routes and procedures.
(G) Decontamination procedures not covered by the site safety and health plan.
(H) Emergency medical treatment and first aid.
(I) Emergency equipment and procedures for handling emergency incidents.
c. The employer should provide hazardous waste employees information and training on personal protective equipment used at the site, such as the following:
(1) PPE to be used based upon known or anticipated site hazards.
(2) PPE limitations of materials and construction; limitations during temperature extremes, heat stress, and other appropriate medical considerations; use and limitations of respirator equipment as well as documentation procedures as outlined in 29 CFR 1910.134.
(3) PPE inspection procedures prior to, during, and after use.
(4) PPE donning and doffing procedures.
(5) PPE decontamination and disposal procedures.
(6) PPE maintenance and storage.
(7) Task duration as related to PPE limitations.
d. The employer should instruct the employee about the site medical surveillance program relative to the particular site, including:
(1) Specific medical surveillance programs that have been adapted for the site.
(2) Specific signs and symptoms related to exposure to hazardous materials on the site.
(3) The frequency and extent of periodic medical examinations that will be used on the site.
(4) Maintenance and availability of records.
(5) Personnel to be contacted and procedures to be followed when signs and symptoms of exposures are recognized.
e. The employees will review and discuss the site safety plan as part of the training program. The location of the site safety plan and all written programs should be discussed with employees including a discussion of the mechanisms for access, review, and references described.
B. RCRA Operations Training for Treatment, Storage and Disposal Facilities.
1. As a minimum, the training course required in 29 CFR 1910.120 (p) should include the following topics:
(a) Review of the applicable paragraphs of 29 CFR 1910.120 and the elements of the employer's occupational safety and health plan.
(b) Review of relevant hazards such as, but not limited to, chemical, biological, and radiological exposures; fire and explosion hazards; thermal extremes; and physical hazards.
(c) General safety hazards including those associated with electrical hazards, powered equipment hazards, lock-out-tag-out procedures, motor vehicle hazards and walking-working surface hazards.
(d) Confined-space hazards and procedures.
(e) Work practices to minimize employee risk from workplace hazards.

(f) Emergency response plan and procedures including first aid meeting the requirements of paragraph (p) (8).
(g) A review of procedures to minimize exposure to hazardous waste and various type of waste streams, including the materials handling program and spill containment program.
(h) A review of hazard communication programs meeting the requirements of 29 CFR 1910.1200.
(i) A review of medical surveillance programs meeting the requirements of 29 CFR 1910.120(p) (3) including the recognition of signs and symptoms of overexposure to hazardous substance including known synergistic interactions.
(j) A review of decontamination programs and procedures meeting the requirements of 29 CFR 1910.120(p) (4).
(k) A review of an employer's requirements to implement a training program and its elements.
(l) A review of the criteria and programs for proper selection and use of personal protective equipment, including respirators.
(m) A review of the applicable appendices to 29 CFR 1910.120.
(n) Principles of toxicology and biological monitoring as they pertain to occupational health.
(o) Rights and responsibilities of employees and employers under applicable OSHA and EPA laws.
(p) Hands-on exercises and demonstrations of competency with equipment to illustrate the basic equipment principles that may be used during the performance of work duties, including the donning and doffing of PPE.
(q) Sources of reference, efficient use of relevant manuals, and knowledge of hazard coding systems to include information contained in hazardous waste manifests.
(r) At least 8 hours of hands-on training.
(s) Training in the job skills required for an employee's job function and responsibility before they are permitted to participate in or supervise field activities.
2. The individual employer should provide hazardous waste employees with information and training prior to an employee's initial assignment into a work area. The training and information should cover the following topics:
(a) The Emergency response plan and procedures including first aid.
(b) A review of the employer's hazardous waste handling procedures including the materials handling program and elements of the spill containment program, location of spill response kits or equipment, and the names of those trained to respond to releases.
(c) The hazardous communication program meeting the requirements of 29 CFR 1910.1200.
(d) A review of the employer's medical surveillance program including the recognition of signs and symptoms of exposure to relevant hazardous substance including known synergistic interactions.
(e) A review of the employer's decontamination program and procedures.
(f) An review of the employer's training program and the parties responsible for that program.
(g) A review of the employer's personal protective equipment program including the proper selection and use of PPE based upon specific site hazards.
(h) All relevant site-specific procedures addressing potential safety and health hazards. This may include, as appropriate, biological and radiological exposures, fire and explosion hazards, thermal hazards, and physical hazards such as electrical hazards, powered equipment hazards, lock-out-tag-out hazards, motor vehicle hazards, and walking-working surface hazards.
(i) Safe use engineering controls and equipment on site.
(j) Names of personnel and alternates responsible for safety and health.
C. Emergency response training.
Federal OSHA standards in 29 CFR 1910.120(q) are directed toward private sector emergency responders. Therefore, the guidelines provided in this portion of the appendix are

directed toward that employee population. However, they also impact indirectly through State OSHA or USEPA regulations some public sector emergency responders. Therefore, the guidelines provided in this portion of the appendix may be applied to both employee populations.

States with OSHA state plans must cover their employees with regulations at least as effective as the Federal OSHA standards. Public employees in states without approved state OSHA programs covering hazardous waste operations and emergency response are covered by the U.S. EPA under 40 CFR 311, a regulation virtually identical to Sec. 1910.120.

Since this is a non-mandatory appendix and therefore not an enforceable standard, OSHA recommends that those employers, employees or volunteers in public sector emergency response organizations outside Federal OSHA jurisdiction consider the following criteria in developing their own training programs. A unified approach to training at the community level between emergency response organizations covered by Federal OSHA and those not covered directly by Federal OSHA can help ensure an effective community response to the release or potential release of hazardous substances in the community.

a. General considerations.

Emergency response organizations are required to consider the topics listed in Sec. 1910.120(q) (6). Emergency response organizations may use some or all of the following topics to supplement those mandatory topics when developing their response training programs. Many of the topics would require an interaction between the response provider and the individuals responsible for the site where the response would be expected.

(1) Hazard recognition, including:

(A) Nature of hazardous substances present,

(B) Practical applications of hazard recognition, including presentations on biology, chemistry, and physics.

(2) Principles of toxicology, biological monitoring, and risk assessment.

(3) Safe work practices and general site safety.

(4) Engineering controls and hazardous waste operations.

(5) Site safety plans and standard operating procedures.

(6) Decontamination procedures and practices.

(7) Emergency procedures, first aid, and self-rescue.

(8) Safe use of field equipment.

(9) Storage, handling, use and transportation of hazardous substances.

(10) Use, care, and limitations of personal protective equipment.

(11) Safe sampling techniques.

(12) Rights and responsibilities of employees under OSHA and other related laws concerning right-to-know, safety and health, compensations and liability.

(13) Medical monitoring requirements.

(14) Community relations.

b. Suggested criteria for specific courses.

(1) First responder awareness level.

(A) Review of and demonstration of competency in performing the applicable skills of 29 CFR 1910.120(q).

(B) Hands-on experience with the U.S. Department of Transportation's Emergency Response Guidebook (ERG) and familiarization with OSHA standard 29 CFR 1910.1201.

(C) Review of the principles and practices for analyzing an incident to determine both the hazardous substances present and the basic hazard and response information for each hazardous substance present.

(D) Review of procedures for implementing actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of DOT's ERG including emergency notification procedures and follow-up communications.

(E) Review of the expected hazards including fire and explosions hazards, confined space hazards, electrical hazards, powered equipment hazards, motor vehicle hazards, and walking-working surface hazards.
(F) Awareness and knowledge of the competencies for the First Responder at the Awareness Level covered in the National Fire Protection Association's Standard No. 472, Professional Competence of Responders to Hazardous Materials Incidents.
(2) First responder operations level.
(A) Review of and demonstration of competency in performing the applicable skills of 29 CFR 1910.120(q).
(B) Hands-on experience with the U.S. Department of Transportation's Emergency Response Guidebook (ERG), manufacturer material safety data sheets, CHEMTREC/CANUTEC, shipper or manufacturer contacts, and other relevant sources of information addressing hazardous substance releases. Familiarization with OSHA standard 29 CFR 1910.1201.
(C) Review of the principles and practices for analyzing an incident to determine the hazardous substances present, the likely behavior of the hazardous substance and its container, the types of hazardous substance transportation containers and vehicles, the types and selection of the appropriate defensive strategy for containing the release.
(D) Review of procedures for implementing continuing response actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of DOT's ERG including extended emergency notification procedures and follow-up communications.
(E) Review of the principles and practice for proper selection and use of personal protective equipment.
(F) Review of the principles and practice of personnel and equipment decontamination.
(G) Review of the expected hazards including fire and explosions hazards, confined space hazards, electrical hazards, powered equipment hazards, motor vehicle hazards, and walking-working surface hazards.
(H) Awareness and knowledge of the competencies for the First Responder at the Operations Level covered in the National Fire Protection Association's Standard No. 472, Professional Competence of Responders to Hazardous Materials Incidents.
(3) Hazardous materials technician.

(A) Review of and demonstration of competency in performing the applicable skills of 29 CFR 1910.120(q).
(B) Hands-on experience with written and electronic information relative to response decision making including but not limited to the U.S. Department of Transportation's Emergency Response Guidebook (ERG), manufacturer material safety data sheets, CHEMTREC/CANUTEC, shipper or manufacturer contacts, computer data bases and response models, and other relevant sources of information addressing hazardous substance releases. Familiarization with OSHA standard 29 CFR 1910.1201.
(C) Review of the principles and practices for analyzing an incident to determine the hazardous substances present, their physical and chemical properties, the likely behavior of the hazardous substance and its container, the types of hazardous substance transportation containers and vehicles involved in the release, the appropriate strategy for approaching release sites and containing the release.
(D) Review of procedures for implementing continuing response actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of DOT's ERG including extended emergency notification procedures and follow-up communications.
(E) Review of the principles and practice for proper selection and use of personal protective equipment.

(F) Review of the principles and practices of establishing exposure zones, proper decontamination and medical surveillance stations and procedures.
(G) Review of the expected hazards including fire and explosions hazards, confined space hazards, electrical hazards, powered equipment hazards, motor vehicle hazards, and walking-working surface hazards.
(H) Awareness and knowledge of the competencies for the Hazardous Materials Technician covered in the National Fire Protection Association's Standard No. 472, Professional Competence of Responders to Hazardous Materials Incidents.
(4) Hazardous materials specialist.
(A) Review of and demonstration of competency in performing the applicable skills of 29 CFR 1910.120(q).
(B) Hands-on experience with retrieval and use of written and electronic information relative to response decision making including but not limited to the U.S. Department of Transportation's Emergency Response Guidebook (ERG), manufacturer material safety data sheets, CHEMTREC/CANUTEC, shipper or manufacturer contacts, computer data bases and response models, and other relevant sources of information addressing hazardous substance releases. Familiarization with OSHA standard 29 CFR 1910.1201.
(C) Review of the principles and practices for analyzing an incident to determine the hazardous substances present, their physical and chemical properties, and the likely behavior of the hazardous substance and its container, vessel, or vehicle.
(D) Review of the principles and practices for identification of the types of hazardous substance transportation containers, vessels and vehicles involved in the release; selecting and using the various types of equipment available for plugging or patching transportation containers, vessels or vehicles; organizing and directing the use of multiple teams of hazardous material technicians and selecting the appropriate strategy for approaching release sites and containing or stopping the release.
(E) Review of procedures for implementing continuing response actions consistent with the local emergency response plan, the organization's standard operating procedures, including knowledge of the available public and private response resources, establishment of an incident command post, direction of hazardous material technician teams, and extended emergency notification procedures and follow-up communications.
(F) Review of the principles and practice for proper selection and use of personal protective equipment.
(G) Review of the principles and practices of establishing exposure zones and proper decontamination, monitoring and medical surveillance stations and procedures.
(H) Review of the expected hazards including fire and explosions hazards, confined space hazards, electrical hazards, powered equipment hazards, motor vehicle hazards, and walking-working surface hazards.
(I) Awareness and knowledge of the competencies for the Off-site Specialist Employee covered in the National Fire Protection Association's Standard No. 472, Professional Competence of Responders to Hazardous Materials Incidents.
(5) Incident commander.
The incident commander is the individual who, at any one time, is responsible for and in control of the response effort. This individual is the person responsible for the direction and coordination of the response effort. An incident commander's position should be occupied by the most senior, appropriately trained individual present at the response site. Yet, as necessary and appropriate by the level of response provided, the position may be occupied by many individuals during a particular response as the need for greater authority, responsibility, or training increases. It is possible for the first responder at the awareness level to assume the duties of incident commander until a more senior and appropriately trained individual arrives at the response site.

Therefore, any emergency responder expected to perform as an incident commander should be trained to fulfill the obligations of the position at the level of response they will be providing including the following:
(A) Ability to analyze a hazardous substance incident to determine the magnitude of the response problem.
(B) Ability to plan and implement an appropriate response plan within the capabilities of available personnel and equipment.
(C) Ability to implement a response to favorably change the outcome of the incident in a manner consistent with the local emergency response plan and the organization's standard operating procedures.
(D) Ability to evaluate the progress of the emergency response to ensure that the response objectives are being met safely, effectively, and efficiently.
(E) Ability to adjust the response plan to the conditions of the response and to notify higher levels of response when required by the changes to the response plan.
[54 FR 9317, Mar. 6, 1898, as amended at 55 FR 14073, Apr. 13, 1990; 56 FR 15832, Apr. 18, 1991; 59 FR 43268, Aug. 22, 1994; 61 FR 9227, March 7, 1996]

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