OSHA's proposal to change the signage requirements in the substance-specific standards was nearly universally supported by commenters. Product Safety Solutions, AHMP, National Paint and Coatings Association, Ameren, Wacker Chemical Corp, ASSE, Stericycle, Phylmar Regulatory Roundtable, Soap and Detergent Association/Consumer Specialty Products Association, Ecolab, Inc., AIHA, ORC Worldwide, National Association of Homebuilders, API, Procter & Gamble Company, Dr. Michelle Sullivan, Clariant Corporation, American Chemical Council, 3M, AISI (American Coke and Coal Chemicals Institute), Industrial Health and Safety Consultants, and NIOSH, in their comments to the NPRM, specifically supported the harmonization of signage required in the substance-specific standards (Document ID #0313, 0327, 0328, 0330, 0335, 0336, 0338, 0339, 0344, 0351, 0365, 0370, 0372, 0376, 0381, 0382, 0383, 0393, 0405, 0408, 0410, and 0412). USSE, agreeing with the commenters above, testified that having the same wording on regulated-areas signs would be helpful to workers as they move around and it is better for them to see the same information they have been trained on (Document ID #0499 Tr. 165).

Commenters raised several signage issues. Dow Chemical advocated the elimination of signs in substance-specific health standards, arguing that there was no need for signs since the chemical will be labeled and workers can also refer to an SDS (Document ID #0353). OSHA disagrees. The substance-specific standards' sign requirements cover regulated areas of facilities that are by definition high-exposure or potentially high-exposure areas. They are among the most dangerous areas in a facility, which is why OSHA requires signs. Moreover, contrary to what Dow assumes, product labels may not always be available in these circumstances. Thus, OSHA disagrees with Dow Chemical and believes the signs convey crucial information about the chemical hazard in a regulated area and that the signs benefit not only the well-trained worker but also other workers who might be near, or inadvertently enter, the regulated area.

The Battery Council International (Document ID #0390) had suggestions for language on regulated area signs for the lead standard, 29 CFR 1910.1025. First, they requested that OSHA change the language from "Causes Damage to the Central Nervous System" to "May Cause Damage to the Central Nervous System," since nerve damage may or may not occur depending on whether or not the facility has taken proper precautions. However, as discussed above, OSHA has updated the signs to be consistent with GHS labeling to ensure that the worker is receiving the same message and this would provide better identification of the hazard. Therefore, OSHA has retained the proposed language for lead regulated area signs in the final.

The Battery Council International also requested that OSHA retain the original language § 1910.1025(m)(2) so that it would be clear that other signage may also be used in places where required (Document ID #0390). For example, it reported that California has such a signage requirement under Proposition 65. OSHA agrees that, in some very specific cases, other warnings may be necessary for lead. Thus, the current requirement that, "The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this paragraph," has been retained in the final rule for the lead standard at § 1910.1025(m)(2)(iv).

OSHA concludes that the proposed changes, which are as close as possible to the GHS terminology, are essential in order to make the warnings on signs consistent with each other, as well as labels, to the extent possible. These consistent warning signs will provide the best hazard communication in the relevant workplace regulated areas. The proposed changes to the signage requirements of the substance-specific standards have been carried through to the final rule.

Hazard Communication, Classification and Labels

OSHA's current substance-specific standards are inconsistent in that some have their own communication of hazards requirements, while other standards reference the HCS, and still other standards have no requirements for labels and safety data sheets in their sections. Although these latter standards are missing requirements, they still are covered by HCS. Similarly for labels, while most substance-specific standards require labels on containers of raw materials, mixtures, and products, some specify specific language while others reference the HCS. As proposed, and as carried forward in this final rule, OSHA has standardized the language for hazard communication and has removed the requirements for specific language labels from the "Communications of hazards" paragraphs of the substance-specific standards. The new paragraph in each substance-specific standard uses the following model format:

Hazard Communication—General.

(i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (29 CFR 1910.1200) for [chemical name].

(ii) In classifying the hazards of [chemical name] at least the following hazards are to be addressed: [hazard information].

(iii) Employers shall include [chemical name] in the hazard communication program established to comply with the HCS. Employers shall ensure that each employee has access to labels on containers of [chemical name] and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph [Training paragraph] of this section.

By adding this paragraph in each substance-specific health standard, OSHA achieves consistency across standards and with GHS principles. Some commenters indicated that the chemicals covered by the substance-specific standards should not be classified any differently than any other chemical in regard to the health hazards included on a label or SDS (*See, e.g.*, Document ID #0365). That was OSHA's intent. OSHA has clarified the regulatory language to minimize confusion. The final rule, like the proposal, requires compliance with the HCS in each substance-specific standard.

OSHA believes that requiring standards to reference HCS will ensure consistency with the GHS revisions and across the standards and consistency when the specific chemical is part of a mixture. Removal of the current specific warning language was essential for adoption of the GHS language. Retention of these provisions in the standards would result in the untenable situation of two potentially conflicting requirements, only one of which (the reference to HCS) would be in accord with the GHS-modified HCS. Moreover, as OSHA noted in the preamble to the proposed standard, the hazard statements specified for the chemical in the standard might not be correct when the chemical is part of a mixture. As for the current standards that simply referenced HCS, employers could choose any language and format that conveyed the necessary information. This approach is no longer allowed because, as OSHA has found in adopting the GHS approach, consistency in labeling is key to effective communication of hazards. The vast majority of commenters agreed. For example, AHMP noted that eliminating language inconsistent with established hazard statements will facilitate hazard communication and should not result in lower protection (Document ID #0327). Others, including NIOSH, DuPont,

Ameren, ASSE, Ecolab, Inc., AIHA, ORC Worldwide, NAHB, API, Procter & Gamble, Dr. Michelle Sullivan, ACC, 3M, AISI, Industrial Health and Safety Consultants, and American Coke and Coal Chemicals Institute, agreed (Document ID #0329, 0330, 0336, 0351, 0365, 0370, 0372, 0376, 0381, 0382, 0393, 0405, 0408, 0410, and 0412). Commenters noted that for the benefits of consistency to accrue, harmonization is essential (Document ID #0313, 0315, 0327, 0328, 0329, 0330, 0335, 0336, 0338, 0344, 0365, 0370, 0372, 0376, 0381, 0382, 0383, 0393, 0405, 0408, and 0410). NIEHS Worker Education and Training Program agreed, testifying that consistency of labels and safety data sheets is important to help employees recognize hazards and be able to deal with them effectively (Document ID #0497 Tr. 104). Phylmar Regulatory said that standardized label elements will be more effective in communicating hazard information (Document ID #0497 Tr. 108–109). AIHA testified that standardized labels will make hazard identification easier and the pictograms will be useful in workplaces where English language reading is limited (Document ID #0496 Tr. 415). USSW affirmed that one hazard communication system would be best (Document ID #0499 Tr. 178). OSHA believes all these commenters provide important and compelling reasons for the labels required by the substance-specific standards to be consistent with the GHS modifications to HCS.

For classification purposes, OSHA proposed to provide guidance on the potential health outcomes that must be addressed when classifying a substance by setting forth the health end-points (outcomes) for each substance-specific health standard. The Agency did not attempt to formally classify each substance; rather, OSHA provided a proposed list of health effects to assist the classifier in determining what must be considered for inclusion on the new labels. The GHS classification process for a specific substance dictates the actual hazard warnings and precautionary statements that are required on the new GHS-compliant labels and SDSs. In determining the hazards to include for each substance-specific health standard, the Agency's primary sources on health effects were the information gained in its own rulemakings and subsequent experience, the NIOSH Pocket Guide to Chemical Hazards (2005), and the International Chemical Safety Cards (ICSCs). The ICSCs are an undertaking of the International Programme on Chemical Safety (IPCS) (a joint activity of three cooperating International Organizations, namely, the United Nations Environment Programme (UNEP), the International Labour Office (ILO), and the World Health Organization (WHO)) and are peer reviewed by a group of internationally recognized experts (Document ID #0412.2). As a secondary source, OSHA also considered the European Union's (EU) "Proposal for a Regulation of the European Parliament and of the Council on Classification, Labeling and Packaging of Substances and Mixtures, and amending Directive 67/548/EEC and Regulation (EC) No 1907/2006." From these sources, OSHA developed hazard endpoints to be considered for hazard classification in the substance-specific health standards based on either of two criteria: (1) The health hazard was the basis for the original rulemaking; or (2) the health hazard was asserted by OSHA, NIOSH, or IPCS, and confirmed by a second source. For example, acrylonitrile (AN) (§ 1910.1045) was regulated by OSHA based on its carcinogenicity. Skin sensitization was acknowledged by OSHA, IPCS, and EU; skin irritation by OSHA, NIOSH, and EU; respiratory tract irritation by IPCS and EU; eye irritation by OSHA, NIOSH, and IPCS; liver effects and central nervous system effects by IPCS and NIOSH; acute toxicity by OSHA, IPCS, and EU; and flammability by IPCS, NIOSH, and EU. Because all these effects met the criteria for inclusion, skin sensitization, skin irritation, respiratory irritation, eye irritation, liver effects, central nervous system effects, acute toxicity, and flammability were listed as potential hazards in the acrylonitrile standard.

OSHA's approach, including its choice of sources for health effects, was generally supported by many commenters to the proposal (Document ID #0329, 0339, 0351, 0370, and 0376). However, some, including NIOSH, AIHA, ASSE, Ameren, Stericycle, Wacker Chemical Corporation, and 3M Corporation, wanted OSHA to add other sources (Document ID #0233, 0330, 0338, 0365, 0405, and 0412). NIOSH suggested OSHA look at OECD SIDS, ESIS, NOAA, NLM, NLM–TOXSEEK, NLM–TOXNET, IPCS, CCOHS, and GESTIS (Document ID #0412). AIHA commented that substance-specific health standards should be classified the same as other chemicals and that other references such as ATSDR Toxicological Profiles, IRIS Toxicological Reviews, WHC Monographs, CICADS, OECD SIDS, and Patty's Toxicology should be used (Document ID #0365). Wacker Chemical Corporation recommended IARC be included and that one recognized body's determination of a hazard should be sufficient (Document ID #0335). ASSE urged inclusion of ACGIH documentation of TLVs and RELs and precautions developed by manufacturers from testing and epidemiological studies. ASSE submitted a long list of sources including NSC's Fundamentals of Industrial Hygiene, The Industrial Environment—Its Evaluation and Control, Patty's Industrial Hygiene and Toxicology, Casarett & Doull's Toxicology, The Dose Makes the Poison, Quick Selection Guide to Chemical Protective Clothing, U.S. DHHS Seventh Annual Report on Carcinogens, AIHA Engineering Field Reference Manual, and 17 others (Document ID #0336). AIHA urged OSHA to have the hazards for the substance-specific standards considered, but not be mandatory. It recommended additional references such as ATSDR Toxicological Profiles, IRIS Toxicological Reviews, EHC Monographs, CICADS, OECD SIDS, and Patty's Toxicology (Document ID #0365). Ameren would have OSHA add ACHIS and AIHA sources (Document ID #0330). Stericycle advocated adding Industrial Chemical Safety Cards, European Commission, and ACGIH as secondary sources (Document ID #0338). Still others, such as ASSE, API, AHMP, Product Safety Solutions, National Paint and Coatings Association, and Industrial Minerals Association—North America, deemed OSHA's choice of sources inadequate (Document ID #0313, 0327, 0328, 0338, 0376, and 0379). USSW (Document ID #0403) found lists such as IARC's and NTP's useful, but wanted OSHA to state in the regulatory text that a chemical on one or more of these lists was sufficient to classify it as hazardous (although the absence of a chemical on a list does not mean it is not hazardous). It also wanted OSHA to use lists in enforcement.

Commenters also raised other issues in this regard. API believed OSHA should just reference the GHS criteria, while ASSE wanted OSHA to use other authoritative references (Document ID #0336 and 0376). Both AHMP and Product Safety Solutions were concerned the NIOSH Pocket Guide and International Chemical Safety Cards had not been subject to rulemaking and could be overly conservative, even though they felt these sources could be used as information, but not as precedent if significant contradictory information is presented (Document ID #0313 and 0327). National Paint and Coatings Association commented that the substance-specific standards' health

hazards should remain as published and only new information should be subject to the two-reference rule (Document ID #0328). Still other commenters, including DuPont Company, Soap and Detergent Association and Consumer Specialty Products Association, Procter & Gamble, and Dr. Michelle Sullivan, expressed concern about whether the sources OSHA was using were to be current or updated, as newer editions become available (Document ID #0329, 0344, 0381, and 0382).

OSHA believes these comments reflect a misunderstanding of what OSHA proposed for its substance-specific health standards and how the sources were used to yield health effects to be considered in classifying all health hazards but not to perform a formal classification. (*See* 74 FR at 50411, Sept. 30, 2009, for the preamble explanation). The substance-specific health standards are unique in that they were all the subject of rulemaking, enabling the Agency to collect extensive information on sources and on health effects. That collection of information, coupled with the Agency's own expertise, enabled the Agency to confidently select sources for these regulated chemicals that would provide adequate information to classifiers. OSHA disagrees with commenters who suggested its chosen sources were inadequate. Some commenters recommended other sources. OSHA believes that these other sources can be useful in classifying hazards, and can certainly be used by classifiers in evaluating the hazards related to chemicals regulated by the substance-specific standards. At issue here, though, is the method OSHA has determined to use for selecting a list of hazard endpoints that, at a minimum, must be considered to provide accurate warnings on labels for its substance-specific standards. OSHA has concluded that the method it used in the proposal is scientifically sound and appropriate.

In complying with the HCS, as discussed above, classifiers must take into account available scientific information about the hazards of the chemical being classified, which could include information found in the other sources noted by the commenters. The manufacturer, distributor, or importer must still classify and categorize each regulated chemical (in the substance-specific health standards) in compliance with the GHS-modified HCS and its appendices. The lists of endpoints for each substance-specific standard are the minimum that must be considered. The manufacturer or importer has leeway to use additional primary studies and sources to evaluate the substance-specific chemical and is free to add health effects' endpoints as appropriate according to the studies or sources. As discussed previously in this section, the HCS generally uses a weight-of-evidence approach in classifying health hazards. Therefore, a superior source or significant and compelling contradictory information to a particular source usually must be weighed with the total body of evidence.

IMA–NA suggested that OSHA's methodology for determining the list of health effects to be considered by classifiers does not meet the requirements of the Information Quality Act (Document ID #0233). OSHA disagrees. That statute, and the guidelines published under it (discussed in more detail above), require that agencies take steps to ensure the "quality, objectivity, utility, and integrity" of information they disseminate. Similar to its response to the concern regarding TLVs, discussed above, OSHA does not believe that it is disseminating information for purposes of the IQA when it merely requires that manufacturers and importers consider specific health effects listed for each substance-specific standard in classifying the chemical under the HCS. However, even if it were disseminating information in the final rule, OSHA believes that it has complied with the applicable requirements of the IQA. OSHA has fully described the methods by which it determined the listed health effects for each substance, relied only on respected health compilations prepared by governmental agencies or subject to peer review, and subjected its analysis to notice and comment in this rulemaking. This adequately assures the quality, objectivity, utility, and integrity of any dissemination of information involved in these provisions of the final rule.

OSHA received no comments on the particular hazards proposed for each substance-specific health standard, and retained them in the final rule. The endpoints for each substance-specific standard are listed in Table XIII–5, "Health Effects Determined for the Substance-Specific Standards."

TABLE XIII–5—HEALTH EFFECTS DETERMINED FOR THE SUBSTANCE-SPECIFIC STANDARDS

Standard No.	Substance	Health effects
1910.1001, 1915.1001, 1926.1101.	Asbestos	Cancer and lung effects.
1910.1003	4-Nitrobiphenyl	Cancer.
1910.1003	Alpha-Naphthylamine	Cancer; skin irritation; and acute toxicity effects.
1910.1003	Methyl chloromethyl ether	Cancer; skin, eye, and respiratory effects; acute toxicity effects; and flammability.
1910.1003	3,3′-Dichlorobenzidine (and its salts)	Cancer and skin sensitization.
1910.1003	Bis-Chloromethyl ether	Cancer; skin, eye, and respiratory tract effects; acute toxicity effects; and flammability.
1910.1003	Beta-Naphthylamine	Cancer and acute toxicity effects.
1910.1003	Benzidine	Cancer and acute toxicity effects.
1910.1003	4-Aminodiphenyl	Cancer.
1910.1003	Ethyleneimine	Cancer; mutagenicity; skin and eye effects; liver effects; kidney effects; acute toxicity effects; and flammability.
1910.1003	Beta-Propiolactone	Cancer; skin irritation; eye effects; and acute toxicity effects.
1910.1003	2-Acetylaminofluorene	Cancer.
1910.1003	4-Dimethylaminoazo-benzene	Cancer; skin effects; and respiratory tract irritation.
1910.1003	N-Nitrosodimethylamine	Cancer; liver effects; and acute toxicity effects.
1910.1017	Vinyl chloride	Cancer; central nervous system effects; liver effects; blood effects; and flammability.
1910.1018	Inorganic arsenic	Cancer; liver effects; skin effects; respiratory irritation; nervous system effects; and acute toxicity effects.

TABLE XIII–5—HEALTH EFFECTS DETERMINED FOR THE SUBSTANCE-SPECIFIC STANDARDS—Continued

Standard No.	Substance	Health effects
1910.1025, 1926.62	Lead	Reproductive/developmental toxicity; central nervous system effects; kidney effects; blood effects; and acute toxicity effects.
1910.1026, 1915.1026, 1926.1126.	Chromium VI	Cancer; skin sensitization; and eye irritation.
1910.1027, 1926.1127	Cadmium	Cancer; lung effects; kidney effects; and acute toxicity effects.
1910.1028	Benzene	Cancer; central nervous system effects; blood effects; aspiration; skin, eye, and respiratory tract irritation; and flammability.
1910.1029	Coke oven emissions	Cancer.
1910.1043	Cotton Dust	Lung effects.
1910.1044	1,2-dibromo-3-chloropropane (DBCP)	Cancer; reproductive effects; liver effects; kidney effects; central nervous system effects; skin, eye, and respiratory tract irritation; and acute toxicity effects.
1910.1045	Acrylonitrile (AN)	Cancer; central nervous system effects; liver effects; skin sensitization; skin, respiratory, and eye irritation; acute toxicity effects; and flammability.
1910.1047	Ethylene oxide (EtO)	Cancer; reproductive effects; mutagenicity; central nervous system; skin sensitization; skin, eye, and respiratory tract irritation; acute toxicity effects; and flammability.
1910.1048	Formaldehyde	Cancer; skin and respiratory sensitization; eye, skin, and respiratory track irritation; acute toxicity effects; and flammability.
1910.1050, 1926.62	Methylenedianiline (MDA)	Cancer; liver effects; and skin sensitization.
1910.1051	1,3 Butadiene (BD)	Cancer; eye and respiratory tract irritation; center nervous system effects; and flammability.
1910.1052	Methylene chloride	Cancer; cardiac effects; central nervous system effects; liver effects; and skin and eye irritation.

The NPRM retained specific language for labels in the substance-specific health standards for containers of contaminated clothing or waste and debris to ensure that protection gained from communicating these hazards to the downstream recipients of the materials would not be lessened. The proposal, however, updated the language to be consistent with the GHS. The labeling requirements in these standards are part of broad protections, resulting from PELs and ancillary provisions such as exposure monitoring, personal protective equipment, and medical surveillance. These requirements for labeling containers of contaminated clothing, PPE, and waste and debris have been an integral part of the standards since their promulgation. To simply conform the labeling requirements for these kinds of containers to the GHS-modified HCS rule would not offer the extra protection currently provided in these standards; because of the variation in the quantity of chemicals in the containers of contaminated clothing, PPE, and waste and debris, the chemical concentration may be lower than the specified cut-off values/concentration limits. In such a case, if OSHA only relied on the GHS-modified HCS labeling requirement, labeling for these containers may not be triggered and protections would be lessened.

Commenters agreed that specific language for labels on containers of contaminated clothing and waste and debris should be maintained. For example, Ameren and 3M Corporation commented that maintaining specific language for labels on contaminated clothing and waste/debris containers for the substance-specific health standards will provide adequate warnings to all (Document ID #0330 and 0405). AIHA, in supporting the specific labels, noted that the workplace-contaminated materials are not hazardous chemicals in commerce; thus, these special labels are not inconsistent with GHS. Further, AIHA said that because recipients of these containers are accustomed to specific warnings, a change, such as elimination of the specific warning language because it might not be required by GHS, might be perceived as a change in hazard (Document ID #0365). The Battery Council International urged OSHA not to eliminate the label language requiring the disposal of lead-contaminated waste water in accordance with applicable local, state, or federal regulations in § 1910.1025(m)(2) for contaminated clothing. OSHA agrees that this information is important and is not inconsistent with GHS labeling. Therefore, OSHA has retained this language for the labels for contaminated clothing and equipment in the final rule. AISI and Industrial Health and Safety Consultants urged OSHA to require that the language on containers of contaminated clothing and waste/debris be in accord with the GHS guidelines. Such harmonization would maintain consistency with other labeling and minimize confusion of downstream handlers (Document ID #0408). In addition, Industrial Health and Safety Consultants felt that containers of contaminated clothing and waste/debris should be classified according to the HCS and the specific language on the label should be eliminated (Document ID #0410). As discussed below, OSHA does not agree. Industrial Health and Safety Consultants also suggested that OSHA require HCS classification and labeling of contaminated waste clothing and waste for all chemicals (Document ID #0410). OSHA did not propose such extensive new requirements for containers of chemically contaminated clothing and waste and debris. These requirements were not part of HCS and would be a significant addition to the final rule.

OSHA agrees with the commenters who advocate retaining the warnings and harmonizing these labels for contaminated clothing and waste and

debris containers, and did so to the extent possible. (*See* 74 FR 50434–50439, Sept. 30, 2009). However, classifying containers of chemically contaminated clothing and waste and debris consistent with GHS would be an impossible task, as substances found on contaminated clothing and waste and debris often occur in unknown, varying, and frequently small quantities. In order to ensure and maintain protection for employees in workplaces that receive these containers, labeling of the hazards with specific language is essential. The warnings, like all other warnings, are most effective when they are consistent with each other and, to the extent possible, with the GHS language. This consistency was achieved with the proposed language. Therefore, the proposed language for the substance-specific standards remains unchanged and is finalized in this rulemaking.

OSHA is adding two warnings to the Cadmium standard, which were left out of one paragraph of the proposal, through an error. In the NPRM, OSHA proposed that the warning labels for waste, scrap, or debris be required to include "Danger"; "Contains Cadmium"; and "May Cause Cancer" in paragraph 1910.1027(m)(3)(ii). The warnings "Causes Damage to Lungs and Kidneys" and "Avoid Creating Dust" were inadvertently left out of this paragraph. (The NPRM properly included these two warnings in paragraph 1910.1027(i)(2)(iv) for bags and containers of contaminated protective clothing and equipment.) OSHA is correcting this error by adding these warnings in this final standard, making the Cadmium standard consistent with the other substance-specific standards and, to the extent possible, with GHS.

In addition, for labels of bags or containers of contaminated clothing and equipment, OSHA has determined precautionary statements that address creating dust in the current substance-specific health standards must be retained even though there is no GHS equivalent. At this time, a work group formed under the UN Sub-Committee of Experts for the GHS (UN Sub-committee) is working to finalize issues related to hazard and precautionary statements. OSHA has recommended to the UN Sub-committee to adopt the phrase "avoid creating dust" as a precautionary statement, if this statement is adopted as a precautionary statement, then this statement will be consistent with the GHS. However, if the UN Sub-committee does not adopt such a statement, OSHA intends to continue to require the dust statements in those paragraphs for labels of bags and containers of contaminated clothing and equipment since OSHA has concluded that removing these statements would be a lessening of protection. An example of requirements for those statements can be found in OSHA's Cadmium standard, § 1910.1027(i), (k), and (m). OSHA also inadvertently removed the term "Avoid Creating Dust" from the Asbestos labeling requirements in § 1910.1001(j) and § 1926.1101(l) of the proposal. As discussed above, OSHA believes that this is a unique statement and should be retained. OSHA is correcting this error by reinstating this phrase in the asbestos labeling requirements in § 1910.1001(j) and § 1926.1101(l).

Occupational Exposure To Hazardous Chemicals in Laboratories: Definitions

OSHA proposed to modify most of paragraph (b), Definitions, in § 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories (the laboratory standard), in order to maintain compatibility with HCS. In particular, OSHA removed the definitions of Combustible liquid, Compressed gas, Explosive, Flammable, Flashpoint, Organic peroxide, Oxidizer, Unstable (reactive), and Water-reactive from paragraph (b). In addition, in the NPRM, OSHA revised the definitions of Hazardous chemical, Physical hazard, and Reproductive toxins in paragraph (b) and added definitions for Health hazard and Mutagen in paragraph (b). By these modifications to § 1910.1450, the proposal sought to ensure that the definitions to the GHS-modified HCS also apply to the laboratory standard (§ 1910.1450). The modification is consistent with the goal of this rulemaking and the original intent of the laboratory standard. OSHA explained in the preamble to the laboratory standard the importance of having the HCS and the laboratory standard both use the same definitions for hazardous chemicals:

> The term "hazardous chemical" used in this final rule relies on the definition of "health hazard" found in the OSHA Hazard Communication Standard. As discussed in the scope and application section above, commenters urged OSHA to maintain consistency in terms between the Hazard Communication Standard and this final standard since laboratories are subject to both regulations.
>
> (55 FR 3315, Jan. 31, 1990).

Ameren agreed with OSHA that "combustible liquid" should be removed from paragraph (b) (Document ID #0330). However, the company recommended that OSHA replace the term with specific flashpoint criteria. OSHA disagrees that a definition for combustible liquid with specific flashpoint criteria differing from GHS-modified HCS should be contained in the laboratory standard. OSHA's intention is to harmonize the laboratory standard with the GHS-modified HCS. The final HCS rule contains definitions of flammable liquids with flashpoint criteria in Appendix B, and these flashpoint criteria include what are currently the combustible liquid classes. The laboratory standard does not contain specific requirements for physical hazards, including flammable or combustible liquids. Rather, this program standard contains requirements for such things as a chemical hygiene plan, employee exposure determination, training, medical consultation and examinations, and recordkeeping. Thus, OSHA does not see a need for including separate flashpoint criteria for flammable or combustible liquids and believes that reference to the flammable liquid categories in HCS is appropriate for § 1910.1450.

OSHA proposed to maintain the current definition of "select carcinogens" in the laboratory standard since the original purpose of the standard was to deviate from the HCS definition and narrow the scope of the standard. As noted in the preamble to the final rule for the laboratory standard, the scope was set for "select carcinogens" based on the small, often minute, quantities of substances handled. OSHA stated its reasons for this deviation in that preamble, and those reasons remain persuasive:

> This final rule, however, modifies the carcinogen definition and the obligatory action so that special provisions must be explicitly considered by the employer, but need only be implemented when the employer deems them appropriate on the basis of the specific conditions existing in his/her laboratory. Moreover, the term, "carcinogen" has been replaced by "select carcinogen" which covers a narrower range of substances * * *
>
> (55 FR 3315, Jan. 31, 1990).

OSHA has thus incorporated in the final rule its proposed changes to the definitions in the laboratory standard.

Appendices

OSHA reviewed the appendices to each of its substance-specific health standards and made the following minor changes necessary to align the appendices with their GHS-harmonized standards.

The language in Appendix B, "Employee Standard Summary," chapter XI, "Signs," in both the general industry and the construction standards for lead (§ 1910.1025 and § 1926.62, respectively) has been made consistent

with the language in their regulatory texts.

In Asbestos § 1910.1001, Appendix F, "Work Practices and Engineering Controls for Automotive Brake and Clutch Inspection, Disassembly, Repair and Assembly (Mandatory)," a reference to paragraph (j)(4) of the standard has been redesignated as paragraph (j)(5) to be consistent with the changes in the regulatory text for § 1910.1001. No changes were made to the construction Asbestos standard § 1926.1101, as none were needed.

Safety Data Sheets

OSHA has changed the term "material safety data sheets" when it appears to "safety data sheets" in both the substance-specific health standards and their appendices. As discussed above, this change reflects the GHS terminology.

Compliance Dates for Substance-Specific Health Standards

OSHA proposed to require implementation of all but one of the revisions to the HCS in three years following completion or promulgation of the final rule. Training was proposed to be required in two years. OSHA noted that during the transition period, an employer could be in compliance with either the current HCS or the revised HCS (the final rule), but there could not be a lapse in compliance. For the final standard, OSHA has decided to align implementation of GHS with the final implementation of GHS in the EU for labeling and SDSs. A full explanation of the information and comments and the Agency's reasoning is set out above in this section.

The proposed changes to the substance-specific health standards required compliance with the HCS, thus incorporating the proposed compliance dates for the revised HCS. One commenter suggested that the proposed sign and label updates be done in accordance with the facility's normal replacement schedule (Document ID #0376). OSHA finds that this is too indefinite a period, because it essentially leaves the compliance date in the hands of each employer. OSHA has concluded that the administration of HCS programs by employers and the communication and comprehension of the hazards by employees will be most effective if the requirement for completion of changes for the substance-specific health standards is the same as for all other chemicals. In a sense, this is just another example of the consistency that was approved by so many of the commenters and hearing witnesses.

Thus, the final rule keeps the compliance dates for the new substance-specific health standard requirements in line with those for the revisions to the HCS. Employers must be using new labels for contaminated clothing and waste and debris by June 1, 2015, the date by which manufacturers and importers must comply with the labeling and SDS requirements of the revised HCS. Employers must post the new signs by June 1, 2016, the same date by which employers must also update their hazard communication plans for any new hazard information they receive as a result of the final rule. In the meantime, as with the revised HCS, employers must comply with either the old or new labeling and signage requirements. Provisions to this effect are inserted for each substance-specific standard in this final rule.

Safety Standards

OSHA proposed modifying safety standards that either directly reference the HCS or provide information pertinent to the SDSs, in particular regarding the storage and handling of chemicals. As noted above, many commenters supported standardizing physical hazard criteria across all applicable OSHA standards (Document ID #0034, 0104, 0105, 0155, 0170, 0171, 0313, 0324, 0327, 0328, 0329, 0336, 0338, 0359, 0365, 0376, 0382, 0395, 0405, 0408, 0410, and 0494 Tr. 91, 162). For example, the Compressed Gas Association (CGA) (Document ID #0324) stated:

> CGA agrees with the harmonization to GHS to align the definitions of the physical hazards to the requirements of the GHS categories in safety standards for general industry, construction, and maritime standards, which either directly reference the Hazard Communication Standard * * * or provide information pertinent to the SDS.

However, some other commenters, and even some who supported applying physical hazard criteria across all standards, raised concerns about storage and handling requirements; degree of impact; potential effects on the scope of the Process Safety Management of Highly Hazardous Chemicals (PSM) standard; and potential conflicts with widely accepted consensus standards (Document ID #0038, 0077, 0104, 0163, 0329, 0335, 0336, 0339, 0366, 0370, 0381, 0383, 0393, 0399, 0414, 0500, 0514, 0530, 0643, 0494 Tr. 91, 162, and 0497 Tr. 81–84).

OSHA agrees with the commenters who supported standardizing physical hazard criteria and is doing so except in some standards, such as OSHA's electrical standards, where conflicts with referenced consensus standards make harmonization inappropriate at this time. OSHA proposed to:

- Incorporate the current HCS definitions of flammable liquid and gas into PSM and health hazard into Hazardous Waste Operations and Emergency Response (HAZWOPER) standards;
- Modify the Welding standard (§ 1910.252) requirements on labeling welding consumables to be consistent with GHS modifications to HCS;
- Amend paragraphs on flammable and combustible liquids to conform categories, terminology, flashpoints (FP), and boiling points to the GHS modifications to HCS;
- Incorporate the modified-HCS definition of flammable aerosols into the Flammable and Combustible Liquids standard, § 1910.106. (In § 1910.106, OSHA is also correcting a rounding error in the conversion from 12 feet to meters. The change is from 3.648 meters to 3.658 meters); and
- Update the acceptable methods for determining flashpoints; but
- Leave unchanged electrical standards in Subpart S for general industry and Subpart K for construction, and explosive standards for general industry (§ 1910.109) and for construction (§ 1926.914).

Commenters overwhelmingly supported ensuring consistency in OSHA standards, while maintaining scope of coverage. (Document ID # 0049, 0050, 0077, 0105, 0123, 0145, 0163, 0170, 0313, 0324, 0327, 0328, 0351, 0359, 0365, 0376, and 0494 Tr. 91, 162). Organization Resource Counselors (ORC) (Document ID # 0494 Tr. 91) testified:

> ORC supports concurrent harmonization of hazard definitions in most OSHA standards. ORC agrees with OSHA's proposal to harmonize hazardous communication components across most other OSHA standards in this rulemaking. ORC believes this is the most efficient way to address this necessary step in ensuring consistent hazard information and eliminating conflicting requirements.

Many comments to the ANPR and the NPRM supported OSHA exempting certain standards such as electrical and explosive standards from harmonization at this time (Document ID # 0047, 0075, 0076, 0104, 0113, 0145, 0163, 0328, 0330, 0336, 0370, 0393, and 0408). For example, the standards in Subpart S contain requirements such as internal design criteria that, if changed, would impact their scope. OSHA's reasons for excluding these standards are explained below. In testimony at the hearing, the ACC (Document ID # 0494 Tr. 162) agreed, stating:

We agree with this approach and therefore would expect that there would be no impact on electrical area classification, facility [s]iting, mechanical integrity, electrical classification, storage quantities, unloading and storage location, ventilation requirements, spill protection, grounding and bonding, tank and vessel design, interlocks and safety devices and process hazard analysis.

As discussed in detail below, in the final rule PSM retains its current scope; HAZWOPER's definition of "health hazard" is modified; the definitions in the Flammable and Combustible Liquids standards are aligned with the GHS modifications to HCS; Welding, Cutting and Brazing labeling requirements were also modified to be consistent with HCS; and a few technical amendments have been made to other safety standards that currently use the term "combustible" in order to keep their scope the same. Also, no changes were made to standards that OSHA proposed to exclude from this rulemaking.

PSM

PSM standards for general industry and construction reference the HCS for their scopes, which are currently set forth in § 1910.119(a)(1)(ii) and § 1926.64(a)(1)(ii) as covering a process which involves a flammable liquid or gas (as defined in § 1910.1200(c) [§ 1926.59(c)] on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more, followed by the listed exceptions in the paragraph.

If OSHA did not modify this provision in this rulemaking, the scope of PSM would expand since the HCS's definition of flammable liquid changes from liquids with a flashpoint below 100 °F (37.8 °C) to the new GHS definition of liquids with a flashpoint at or below 199.4 °F (93 °C) (though, as discussed above, the scope of the HCS is unaffected). Keeping the reference to the HCS definition would mean that many more processes would have been covered by the PSM standards than when those standards were promulgated. OSHA does not intend to expand the scope of the PSM standards. Therefore, to maintain the scope of those standards, OSHA proposed to modify the language in the scope paragraphs § 1910.119(a)(1)(ii) and § 1926.64(a)(1)(ii) to read:

A process which involves a Category 1 flammable gas (as defined in § 1910.1200(c)) or flammable liquid with a flashpoint below 100 °F (37.8 °C) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more * * *

In other words, for PSM, "flammable gas" includes Category 1 flammable gases and liquids only if they have flashpoints below 100 °F (37.8 °C) to be consistent with the criteria specified in the current HCS.

Commenters who considered the issue differed on what should be done (Document ID #0324, and 0402). For example, ACC, in responding the NPRM, supported OSHA's approach (Document ID # 0393). ACC noted that OSHA's proposed regulatory language for § 1910.119, the general industry PSM, appropriately reflected the new cut-off without changing the scope of the regulation (Document ID #0393). However, CGA requested that OSHA update paragraph (a)(1)(ii) of § 1910.119 to use GHS Category 1 flammable liquids as a cutoff for PSM coverage, stating, "This would maintain consistency throughout the OSHA standards and harmonization with the GHS" (Document ID #0324). The Society of Chemical Manufacturers and Affiliates (SOCMA) (Document ID #0402) was concerned that the change in the flashpoint trigger for flammable liquids from "the current 100 °F to the new 140 °F * * * would significantly expand the number of products subject to OSHA 1910.106 (flammable liquids), and OSHA 1910.119 (Process Safety Standards)."

While OSHA agrees with CGA that using GHS Category 1 flammable liquids would maintain consistency throughout the OSHA standards, to do so would change the scope of the PSM standard by making it applicable only to flammable liquids with flashpoints below 73 °F (23 °C). This would significantly narrow the scope of PSM and lessen worker protection by eliminating from coverage flammable liquids with flashpoints from 73 °F to below 100 °F. However, to set the coverage of PSM to 140 °F (flammable liquid categories 1, 2 and 3 which require the hazard warning "flammable" to appear on labels), as SOCMA noted, would expand the coverage beyond the scope of the original standard.

OSHA has concluded that setting the flashpoint below 100 °F (37.8 °C), the previous HCS level, properly maintains the scope of the PSM standards as they were promulgated. As explained in the proposal, OSHA's approach to the other affected standards is to "modify provisions of the standards that reference the HCS definitions to maintain coverage or consistency with the modified HCS" (74 FR 50404, Sept. 30, 2009). It is beyond the scope of this rulemaking to consider whether, as a substantive matter, the scope of the PSM standards should be changed. Thus, OSHA is neither increasing nor decreasing the scope of the PSM standard; consequently, the same products in the same quantities will be covered. The final rule adopts the proposed changes to the PSM standards noted above.

HAZWOPER

In the NPRM, OSHA updated the definition of health hazard in its HAZWOPER standards, § 1910.120(a)(3) for general industry and § 1926.65(a)(3) for construction, so that the terminology is aligned with the GHS health hazards in § 1910.1200, Appendix A. The final rule retains the proposed definition.

In proposing this change, OSHA was concerned that some of the terminology in HAZWOPER, such as neurotoxin and nephrotoxin, which were partly defined by reference to the HCS, would no longer be consistent with the GHS-modified HCS. For consistency, the proposal removed such terms from HAZWOPER and are now subsumed within the HCS specific target organ toxicity category, thus maintaining the same hazard communication requirements in both HAZWOPER and HCS. By updating the definition of "health hazard" in the HAZWOPER standards to clearly reference HCS, employers will have the proper reference to HCS and, in there, the proper guidance on how to classify the health hazards. OSHA received no contrary comment, and the final rule adopts the definition of health hazard as proposed.

The ACC requested that OSHA clarify how the HAZWOPER standards would be affected by OSHA's adoption of the GHS flammable and combustible liquid classifications in § 1910.106, § 1926.152, and § 1926.155 (Document ID # 0393 and 0530). ACC seems to be asking why OSHA did not reference the new definitions (GHS categories) of flammable liquids in HAZWOPER. OSHA believes the HAZWOPER standards would not be directly affected by the GHS-harmonized categories of flammable liquids, and therefore ACC's concern is misplaced. The HAZWOPER standards are program standards, and they do not contain any specific references to flammable or combustible liquids. It is true that the HAZWOPER standards state that all requirements of Parts 1910 and 1926 of CFR title 29 apply to hazardous waste and emergency response (§ 1910.120(a)(2) and § 1926.65(a)(2)). Thus, where HAZWOPER-covered employees are responding to an emergency situation where flammable liquids have been stored or need to be temporarily stored during clean-up, the flammable liquid standards might apply. OSHA believes that even in those situations, GHS harmonization of flammable liquids will

have little or no effect on the HAZWOPER standards, because the substantive requirements of these standards have not significantly changed.

Welding, Cutting and Brazing—General Requirements

OSHA is harmonizing the requirements in the Welding, Cutting and Brazing standard, § 1910.252, by adding a Hazard Communication paragraph and bringing in line with the GHS and OSHA's substance-specific health standards the terminology in the labeling requirements for filler metals and fusible granular materials, filler metals containing cadmium, and fluxes containing fluorine compounds.

The final rule retains the proposed text of the Hazard Communication paragraph at § 1910.252(c)(1)(iv). Similar to the substance-specific standards, the welding standard's hazard communication paragraph requires employers to include welding contaminants in a program established to comply with the HCS (§ 1910.1200). Also, similar to the substance-specific standards, OSHA has added a date paragraph requiring employers to be using new labels by June 1, 2015, the date by which manufacturers and importers must comply with the labeling and SDS requirements of the revised HCS.

In addition to adding the general Hazard Communication paragraph, OSHA reorganized some of the paragraphs in § 1910.252 so as to place the general reference to HCS in the correct position in the standard, § 1910.252(c)(1)(iv). To accomplish this, OSHA moved the "Additional considerations for hazard communication in welding, cutting, and brazing," including filler and fusible granular materials, materials containing cadmium, and materials containing fluorine compounds, from paragraphs (c)(1)(iv)(A) through (C) to new paragraphs (c)(1)(v)(A) through (D).

The proposal inserted a cross reference to § 1910.1200 in the welding standards hazard determination section. In addition, as with the substance-specific standards, the proposal deleted specific label language requirements for welding materials containing cadmium and fluorine and instead listed specific health endpoints to be considered in the classification.

OSHA received one comment on the proposed changes from the Gases and Welding Distributors Association, Inc. (GAWDA). While GAWDA generally supported OSHA's rulemaking effort, GAWDA requested that OSHA change "suppliers" of welding materials to "manufacturers" in § 1910.252(c)(1)(v)(A) of the proposal (Document ID # 0388). GAWDA stated the term "supplier" is undefined and might include different entities in the supply chain; furthermore, elsewhere OSHA places the responsibility of hazard determination on manufacturers, importers, and distributors. However, OSHA would like to point out that the term "supplier" is used in the current standard, which requires suppliers to determine the hazards in § 1910.252(1)(c)(iv): "The suppliers of welding materials shall determine the hazard, if any, associated with the use of their materials in welding, cutting, etc." OSHA assumes that "suppliers" will continue to use the same method that they are currently using to determine the hazards of their materials. To change this term could result in a substantive change in the scope of this standard and would be beyond the scope of this rulemaking. Therefore OSHA will retain the word "suppliers" as proposed.

In addition, as discussed in the preamble to the proposal, *See* 74 FR 50417 (Sept. 30, 2009), current § 1910.252(c)(iv) does not merely require suppliers to determine the hazards of their products, but also to ensure that labels properly convey those hazards. A requirement that a supplier only determine the hazard of its products is of little value if they do not also convey information about those hazards on to the persons who use it. The final rule provides additional clarity that suppliers of welding products covered by the standard label as well as determine the hazard.

The changes to this standard were predicated on achieving consistency with the GHS modifications to HCS and other OSHA substance-specific standards, and OSHA has concluded that the modifications as proposed and as explained in the previous paragraphs will effectuate harmonizing the standard's terminology with HCS. In addition, this action also contributes to internal consistency by making the Welding, Cutting, and Brazing standard similar to the substance-specific health standards.

Flammable and Combustible Liquids

OSHA proposed to align the definitions of flammable and combustible liquids in both the general industry and construction standards to conform to the GHS modifications to the HCS. In particular, the proposal changed the definitions of flammable liquid categories and deleted the term and definition of combustible liquids (*See* Table XIII–6 for comparison of the GHS-modified HCS definitions and the current flammable and combustible definitions that were contained in 29 CFR 1910.106 and 29 CFR 1926.155). OSHA has concluded that the proposed changes to the § 1910.106 and § 1926.155 definitions are reasonably necessary and appropriate and carried them forward into the final rule. In addition, to essentially maintain the scope of the standards, OSHA proposed, and is maintaining in the final rule, the addition of the flashpoint cut-off value where the GHS flammable liquid categories overlapped with the current HCS classes. The Alliance of Hazardous Materials Professionals and David Levine of Product Safety Solutions agreed, stating: "The elimination of the term 'combustible' and substitution of actual flash point data provide a more meaningful definition in the affected standards" (Document ID # 0313 and 0327).

OSHA proposed to drop the current rules' classifications of flammable and combustible liquids in favor of the GHS flammable liquid classifications. This meant that all liquids under the proposal would fall into GHS flammable liquid Categories 1 through 4, and that the term "Combustible Liquids" in §§ 1910.106, 1910.107, 1910.123, 1910.125, 1926.152, and 1926.155 was proposed to be deleted since the GHS does not have a hazard class titled "Combustible liquids." However, the GHS does require the hazard statement "combustible liquid" on the label for Category 4 Flammable liquids (flashpoint greater than 60 °C (140 °F) but not greater than 93 °C (199.4°F)).

In addition, the current general industry Spray Finishing standard, § 1910.107, relies on the current § 1910.106 definition of Class IIIB liquids (liquids with a flashpoint over 93 °C). Therefore the proposal amends § 1910.107 to replace its use of the term "combustible liquids," which has no corresponding GHS category, with the phrase "Liquids with a Flashpoint Greater than 93 °C (199.4 °F)." With the new terminology, the protection provided by the original standards remains the same.

OSHA believed that most of the proposed changes in the definitions were not significant. The move to GHS categories entails nominal changes to the flashpoint values for flammable and combustible liquids from 22.8 °C (73 °F) (current Class IA/B cut-off) to 23 °C (73.4 °F) (GHS Category 1/2 cut-off) and from 93.3 °C (200 °F) (current Class IIIB cut-off) to 93 °C (199.4 °F) (GHS Category 4). OSHA believes these changes in flash point represent simple rounding to the closest significant value

and that they would have no significant effect on the scope of its standards or on employee safety. ACC agreed with OSHA, stating that "the elimination of the term 'combustible liquid' in § 1910.107 does not significantly change the requirements of the standards and should not adversely affect industry's ability to comply with the standard" (Document ID #0393). OSHA has concluded these new whole numbers are minute changes and that the rounded numbers coincide with GHS, are easier to understand and remember, and therefore will improve communication of hazards.

However, OSHA requested comment in the proposal on one change that was potentially significant. Under the proposal, the boiling points used to define the threshold for the current Flammable Class IA in § 1910.106 shifted from the cut-off value of 37.8 °C (100 °F) to a cut-off value of 35 °C (95 °F) for GHS Category 1. Likewise, the boiling points in the proposed definition of Flammable Class IB (§ 1910.106) shift from equal to or greater than (≥) 37.8 °C (100 °F) to greater than (≥) 35 °C (95 °F) in GHS Category 2 (*See* Table XIII–6). The Agency believed the changes would be necessary to make OSHA standards internally consistent and consistent with the GHS modifications to HCS. However, as discussed in the NPRM, OSHA was concerned that changing the boiling point cut-off for the highly flammable liquids classified as Flammable IA could, under the GHS modifications to HCS, lead to a subset of these chemicals being classified as GHS Category 2 Flammable Liquids. Since some of the storage and handling requirements are based on the hazard category, the proposal would allow a facility to use larger tanks to store liquids with boiling points between 37.8 °C (100 °F) and 35 °C (95 °F). OSHA was concerned that this practice could decrease safety. OSHA reviewed the properties related to the flammability of approximately 900 chemical substances (754 liquids) listed in the *CRC Handbook of Chemistry and Physics* [85th edition]. Approximately 1 percent of this list of flammable liquids would result in a reclassification from the current Flammable and Combustible Liquids Standard Class IA to GHS Category 2. While this is a small percentage of the total flammable liquids, it represents approximately 15 percent of the Flammable and Combustible Liquids Standard Class IA liquids on this list. OSHA was concerned that this was an instance where the benefits of harmonization could have been in conflict with the measure of safety currently provided and therefore requested comments on this issue.

Most agreed with OSHA that resulting reclassifications of liquids with borderline flashpoints from the old Class IA to the GHS Category 2 was not significant (Document ID #0313, 0324, 0327, 0328, 0338, 0352, 0365, 0366, 0370, 0376, 0382, 0383, 0393, 0405, 0408, 0410, and 0494 Tr. 56). National Association of Chemical Distributers (NACD) stated that "Several NACD members handle flammable liquids under Category 1 and 2. However, the proposed changes would result in few operational changes" (Document ID # 0341). Several commenters pointed out that aligning the definitions for flammable liquids is consistent with the single worldwide definition for these hazards (Document ID #0313 and 0327). ORC (Document ID #0370) stated:

> ORC agrees that the methods OSHA proposes to classify flammable liquids Category 1and 2 and flammable aerosols are similar enough to the current definitions that substances that are currently regulated by OSHA would continue to be regulated and that few, if any, changes would result in a shift in regulatory coverage.

The National Fire Protection Association (NFPA) (Document ID #0366 and 0497 Tr. 56) stated:

> NFPA agrees with OSHA's assessment regarding the slight adjustment resulting from the change in criteria for flash point and boiling point for flammable liquid categories when applying the GHS criteria. NFPA believes the overall impact of the changed flash point and boiling point will be negligible.

The American Petroleum Institute (API) urged OSHA to be consistent across all standards (Document ID #0376). Further, the ACC commented that in reference to the boiling point cut-off for Category 1 and 2 flammable liquids, they believe the language (in the NPRM) is sufficient to reflect the cut-off without changing the scope of the regulation (Document ID #0393).

However, some commenters expressed concern that the shift in flammability criteria would require facilities to modify their storage facilities to maintain compliance with § 1910.106, and consequently storage receptacles would have to be smaller, leading to less storage and greater costs (ISSA, Document ID # 0399). That concern is misplaced because the change from OSHA's old flammable and combustible classes to GHS categories involves a *lowering* of the boiling point cut-offs by 2.8 °C (5.04 °F), so that employers will still be able to use current handling and storage practices affected by the change. Likewise, current storage and handling practices for chemicals whose boiling points fall between 37.8 °C and 35 °C would still be allowed under the proposal. SOCMA commented that changing the definition would expand the number of products subject to § 1910.106 (Document ID #0402). That is also not correct. Due to the rounding of GHS flashpoints, cut-offs are slightly less stringent (*See* Table XIII–6) and no new chemicals would be regulated.

TABLE XIII–6—FLAMMABLE LIQUID DEFINITIONS

GHS			Flammable and combustible liquids standard (29 CFR 1910.106)		
Category	Flashpoint °C (°F)	Boiling point °C (°F)	Class	Flashpoint °C (°F)	Boiling point °C (°F)
Flammable 1	<23 (73.4)	≤35 (95)	Flammable Class IA	<22.8 (73)	<37.8 (100)
Flammable 2	<23 (73.4)	>35 (95)	Flammable Class IB	<22.8 (73)	≥37.8 (100)
Flammable 3	≥23 (73.4) and ≤60 (140)		Flammable Class IC	≥22.8 (73) and <37.8 (100).	
			Combustible Class II.	≥37.8 (100) and <60 (140).	
Flammable 4	>60 (140) and ≤93 (199.4).		Combustible Class IIIA	≥60 (140) and <93.3 (200).	
None			Combustible Class IIIB	≥93.3 (200)	

The American Society of Safety Engineers (ASSE) agreed with OSHA's assessment of the storage issue. ASSE noted that the differences in boiling points from the original § 1910.106 to the GHS Categories could increase the number of gallons allowed to be stored in rooms and cabinets as well as the size of containers for certain liquids. However, in its opinion, the "slightly" increased boiling point would be of "little significance" (Document ID #0336). Therefore, based on the analysis discussed above and the comments received, OSHA has concluded that the shift in boiling point and the minor changes in temperatures and the re-categorizing of flammable liquids are insignificant and will have a negligible impact on the protection provided by the standards that use these terms.

Most commenters supported OSHA's proposal to incorporate the GHS definitions for flammable liquids into its safety standards (Document ID #0313, 0327, 0328, 0338, 0365, 0376, 0405, 0408, and 0410). Some stressed the "consistency" benefits from harmonization (Document ID #0338, 0405, and 0408). ASSE (Document ID #0336) said:

> In response to OSHA's proposal to eliminate the term "combustible liquid" in 29 CFR 1910.106, 1910.107, 1910.123, 1910.124, 1910.125, and 1926.155 for liquids with a flashpoint above 100 degrees F., ASSE believes this list of standards is appropriate. * * * However, ASSE urges OSHA to remove the term "combustible liquid" for all liquids and use the GHS criteria for all flammable liquids.

The National Paint and Coatings Association (NPCA), in supporting the removal of the term "combustible liquid," noted that it was consistent with DOT (Document ID #0328).

Although there was considerable support for the changes OSHA made in the proposal to the flammable and combustible liquid categories, OSHA also received comments suggesting that the deletion of the "combustible" designation and the combining of NFPA Class 1C flammable and Class II combustible liquids into new Category Flammable 3, would lead to confusion among engineers, employers, and employees, which could result in potential accidents (Document ID #0344, 0366, 0381, 0399, 0402, 0498, 0500, 0514, and 0643). In addition, some commenters questioned whether the OSHA standards that address flammable liquids that are not covered by GHS (Combustible Class IIIB) are best handled by replacing the term "combustible" with a quantitative definition so as to maintain their coverage (Document ID #0336, 0366, and 0497 Tr. 56–58 and 68).

Some organizations, though they supported the proposed changes in general, had some specific concerns, particularly with how the OSHA GHS harmonization works with other national standards, including consensus standards. Clariant Corporation opined that eliminating the term "combustible liquid" will likely cause some confusion since it is still used by NFPA and DOT but urged OSHA to adopt the GHS criteria to maintain global consistency (Document ID #0383). However, OSHA points out that, as mentioned above by NPCA, the GHS criteria are consistent with DOT. The American Federation of State, County and Municipal Employees (AFSCME) favored OSHA's GHS harmonization, but sought clarification or additional guidance on how secondary labeling systems such as NFPA's 704 Diamond or the Hazardous Materials Information System (HMIS) would be used once GHS was in effect (Document ID #0414).

NFPA testified that the GHS categories would conflict with NFPA's established hazard ratings in NFPA 704, which has been in effect since the 1950s. NFPA recommended that the term "combustible liquid" not be deleted (Document ID #0497 Tr. 59–64). In addition, NFPA expressed concern that there may be additional confusion since the rating system in NFPA 704 expresses the most hazardous as a "4" while the GHS classification criteria expresses the most hazardous as Category "1". The International Fire Marshals Association (IFMA), echoing the sentiments of the NFPA, agreed that users have been relying on the NFPA 704 Hazard Rating and the Hazardous Material Information System (HMIS) systems for a long time and would be confused by the change (Document ID #0497 Tr. 80–84).

These commenters were concerned that the proposed realignment of the flammable liquid categories would result in confusion among employees, emergency responders, authorities having jurisdiction, and others who have been used to the distinction between flammable and combustible liquids (Document ID #0344, 0366, 0381, 0399, 0402, 0498, 0500, 0514, 0643, and 0497 Tr. 56–58). NFPA (Document ID #0366) stated:

> NFPA is also concerned with the elimination of the "combustible liquids" classification that will occur with the adoption of GHS as we believe there will be considerable confusion among the workers who have been instructed to take specific precautions for various liquids based on whether they were identified as "flammable or combustible." Further, we believe that the elimination of the "combustible liquid" classification may cause confusion among emergency responders and authorities having jurisdiction, who have until now understood that "flammable liquids" can be expected to be ignitable at ambient temperatures, while "combustible liquids" typically require some degree of heating to reach their flash point temperatures. This lack of definition may also be an issue, albeit to a lesser extent, among designers who have been trained to apply certain fire protection measures to "flammable liquids", but not to "combustible liquids." The immediate recognition that has existed in the workplace for decades may be removed by the proposed rule; NFPA cautions OSHA that confusion among workers has the potential to be more significant than OSHA has acknowledged.

See also Document ID #0497 Tr. 56–58.

As an initial matter, OSHA notes liquids with a flashpoint greater than or equal to 60 °C (140 °F) and less than 93.3 °C (200 °F), which are currently classified as "combustible," will be labeled as "combustible liquids" under the final rule. Thus this minimizes the potential for the confusion that NFPA suggests for these chemicals.

In any event, OSHA believes that there is currently confusion and inconsistency in this area. For example, OSHA standards have several cutoff values for flammable and combustible liquids. In OSHA's general industry standard at § 1910.106, 100 °F is the cut-off between flammable liquids and combustible liquids, but in construction, § 1926.155, 140 °F is the cut-off between flammable and combustible. Even the NFPA's standards are confusing. In NFPA 30, the hazard levels are structured from Ia/b/c to III b, with Ia being the highest, while in NFPA 704 the hazard levels range from 1 to 4, where the highest hazard category is 4 and the lowest is 1. NFPA classification and rating systems have been in existence since the 1950s and while the NFPA rating system is widely used, it is still not universally used or understood. Testimony from Mr. Frederick of the United Steelworkers indicated that NFPA is a good quick reference although (he believed) it does not cover all hazards, but it is used to alert workers that they must look elsewhere for additional information (Document ID #0499 Tr. 155–169).

In addition, OSHA reviewed randomly chosen SDSs for liquids classified under the current standard to determine how NFPA ratings correlated to hazard warnings. As shown in Table XIII–7, the hazard warnings were inconsistent, while the MSDSs were all technically correct for physical properties. For example, the hazard warning for flammable liquids with a

NFPA rating of 3 ranges from "Flammable Liquid" to "Extremely Flammable" to "Severe." Notably, cyclohexanone, currently classified as a combustible liquid under § 1910.106, bears the hazard statement "Flammable."

TABLE XIII–7—MSDS COMMUNICATIONS OF FLAMMABLE LIQUID HAZARD WARNINGS

Docket #	Chemical name	Flashpoint	NFPA rating listed	Hazard warning
0565	Toluene	40.7 °F	3	Flammable Liquid
0566	Turpentine	95 °F	3	Flammable Liquid
0570	Aliphatic Hydrocarbons	120 °F	None listed	Flammable Liquid
0571	Reagent N Hexane	−22 °F	3	Extremely Flammable
0567	Paint Thinner	104 °F	2	Combustible
0557	Reagent Alcohol	55 °F	3	Severe (flammable)
0599	Cyclohexane	0 °F	3	Extremely Flammable
0560	Cyclohexanone	111 °F	2	Flammable

OSHA believes that this rulemaking will promote greater harmonization of hazard warnings in the future. Now, when a chemical falls in a particular flammable liquid hazard category, the HCS requirements will dictate the appropriate hazard warning. At least one comment alleges this has already happened in the United States. Dr. Michele Sullivan pointed out that the U.S. Department of Transportation (DOT) is already aligned with the GHS physical hazard criteria (the GHS criteria for physical hazard was based on the DOT physical hazard criteria); thus is already aligned with GHS flammable liquid criteria. Therefore, OSHA is aligning with DOT with this rulemaking (49 CFR 173.120 and Document ID #0382).

Neither the proposal nor final rule prohibits the use of NFPA or HMIS rating systems. They do not prohibit the use of NFPA definitions for employers taking preventive measures in designing facilities or implementing fire protection systems such as automatic sprinklers to ensure a safer situation. OSHA's requirements, even with the substitution of the term "flammable" for "combustible," do not prohibit safer workplace designs or installations. Furthermore, OSHA expects that engineers and other professionals will use the actual flashpoints and other properties of the liquids themselves in design and installation of controls rather than a designation of a liquid as "flammable" or "combustible." IFMA agreed with this premise (Document ID #0497 Tr. 84–85). In any event, even if the engineer, facility designer, or employer is somehow misled by § 1910.106's use of the term "flammable," which has traditionally connoted a higher level of hazard, the result should be an error on the side of safety, rather than of less protection.

During the public hearings, ORC Worldwide commented on OSHA's review of the standards affected by this rulemaking, stating support for the "concurrent harmonization of hazard definitions in most OSHA standards." However, ORC also "agrees with member concern that changes to definitions in § 1910.106, Flammable and Combustible Liquids, while not increasing the scope of the standard, may cause confusion to workers who are familiar with NFPA nomenclature for these materials" (Document ID #0494 Tr. 91–92). OSHA asked ORC to elaborate on this concern and provide support for their testimony. In response, ORC (Document ID #0643) provided two hypothetical situations it believes show that confusion over the realignment of flammable and combustible liquid categories could be significant:

> Consider an engineer who is designing a new warehouse. (New) Category 3 liquids are to be stored therein, and these are liquids which were previously called "combustible." Engineer does not design an electrical classification for the area. He does not realize that the new category may also include some liquids which are flammable. Because of this design outage, an electrical issue causes a fire and the warehouse burns down.
> Consider a dry cleaning business that is using a (new) Category 3 solvent and does not include automatic sprinklers because the team is familiar with this solvent as being "combustible" under the previous NFPA definitions. A different, more effective solvent is proposed, also (new) Category 3, and is accepted as being "similar"—the manufacturer reassures them that the new solvent is in the same flammability category as the previous one. But this one is indeed flammable and would require automatic sprinkler protection under NFPA rules. A fire starts with the new solvent, and because no automatic sprinklers exist onsite, the dry cleaner burns down.

OSHA thanks ORC Worldwide for their testimony and for providing examples of where revisions to standards affected by this rulemaking might cause confusion. With regard to the situations presented by ORC, OSHA understands that the engineer designing the sprinkler system would be required to follow local and state building codes, along with NFPA codes or other building codes, such as NFPA 1 (Fire Code), NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 30 (Flammable and Combustible Liquids Code), NFPA 32 (Standard for Dry Cleaning Plants), NFPA 5000 (Building Construction and Safety Code), and the International Building Code (published by the International Code Council) as well as any OSHA standards that would apply.

The design of a system is not predicated on one physical property, and a prudent engineer or sprinkler designer should be aware that there are special requirements for the storage of combustible and flammable liquids. The codes and standards mentioned above all refer to NFPA 30 for requirements related to the storage and use of flammable and combustible liquids. There are restrictions on maximum container size, maximum storage height, and maximum total quantity stored based on flashpoint.

With regard to the change in solvent used at a dry cleaning facility, the argument remains the same as for the design engineer mentioned above. The flashpoint determines the classification of the chemical. The automatic sprinkler system design would be based on the flashpoint and not the class of chemical being used. OSHA concludes that commenters' concerns about confusion are not well founded and has decided to retain the GHS definition for flammable liquids as proposed in the final rule.

Two commenters, Procter & Gamble and ISSA, believed OSHA was adopting the 140 °F flashpoint cut-off as the definition of a flammable liquid and that this would conflict with the current flashpoint cut-off of 100 °F in § 1910.106 (Document ID #0381 and 0399). Procter & Gamble, arguing that the GHS was designed for hazard communications and not intended to regulate design criteria and that aligning

the GHS criteria for flammable liquids in OSHA's safety standards would have unintended consequences (Document ID #0381), offered OSHA two options:

Option 1: Leave the current OSHA definition of flammable liquids unchanged. This is easy, clear, and no-cost to U.S. industry.
Option 2: In principle, GHS is a labeling and hazard communication system, and was not intended to regulate the design and operation of facilities. OSHA 1910.106, by comparison, is a risk management regulation used in such design and operation. If OSHA adopts the GHS Building Block of 140 °F, leave the parallel definition of 100 °F intact in 1910.106. This dual system will create some confusion, but will minimize the negative effects listed above.

As an initial matter, Procter & Gamble misunderstood how OSHA incorporated the GHS flammable liquid definitions into the safety standards. This change was made only to align terminology. In fact, OSHA agrees that the GHS was not intended to regulate design criteria. Therefore, OSHA proposed to leave the standard's design criteria intact by using the actual measurable flashpoint as the defining criterion. The proposal, adopted by the final rule, is similar to Procter & Gamble's Option 2 and accomplishes both harmonization with GHS and retention of OSHA's long-established and effective risk management practice.

Finally, there were concerns that realigning the flammability criteria could affect contracts. Phylmar Regulatory Roundtable (PRR), which did not oppose OSHA's alignment of definitions of flammable and combustible liquids with the GHS categories, was concerned the reclassification of chemicals may cause conflicts in contracts with customers. PRR stated that the contracts require specifications in products manufactured, engineering controls, personal protective equipment, and specified instructions. PRR claimed that in such a situation the manufacturer by contract is permitted no deviation from the contract or process standards (Document ID #0514). However, as stated above, OSHA has not changed the scope or the requirements of its standards. Therefore, OSHA has concluded there is unlikely to be any interference with contracts. Moreover, where distinctions must be made in the OSHA requirements between the former Class 1C flammable liquids and Class II combustible liquids, the OSHA requirements have specified such distinctions with specific flashpoints. The contents and scopes of the regulatory paragraphs are not affected by GHS reclassifications or terminology changes, nor are OSHA's ventilation, respiratory protection, and personal protective equipment standards. In addition, OSHA did not change standards, like its electrical standards, that address internal design criteria.

OSHA has decided to remain consistent with GHS and not create additional flammable liquid categories. However, § 1910.106(18)(ii)(b) defines Combustible Class IIIB liquids as liquids with flashpoints at or above 200 °F (93.3 °C). While Class IIIB liquids are not included in the scope of § 1910.106, there is no such exemption in the Spray Finishing standard, § 1910.107 (OSHA letter of interpretation, Aug. 15, 2006). In order to preserve coverage in standards such as Spray Finishing, these liquids are now called "Liquids with a Flashpoint of >93 °C (199.4 °F)." Similar to § 1910.106, the use of the flashpoint cut-off is the best way to stay as close to the GHS and maintain scope and consistency within the standards. The Soap and Detergent Association (SDA) and the Consumer Specialty Products Association (CSPA) in a joint comment stated that OSHA should "correct" § 1910.107(e) and (e)(4) and § 1910.124(c)(2) to read "Liquids with a Flashpoint at or below 199.4 °F" to be consistent with the GHS criteria (Document ID #0344). However, if OSHA were to adhere strictly to GHS in this instance and drop the higher flashpoint category, protection from this hazard would be lost and safety compromised.

Several commenters addressed this issue. ASSE stated that their "members do not see the need for the fifth category of 'Flammable Liquids Over a Flash Point of 93.3 °C.' Specific flash point criteria should be used" (Document ID #0336). NFPA expressed general concern about the elimination of the Class IIIB liquids by the adoption of the GHS categorization system, though they acknowledged that OSHA had proposed to extend liquids as "flammable liquid with flash point greater than 93 °C" (Document ID #0366 and 0497 Tr. 56–58). The point was further clarified upon questioning at the hearing where NFPA agreed that by extending the liquids to flashpoints greater than 199.4 °F, OSHA was providing the coverage for § 1910.107 that had always been there. In addition, NFPA recommended it be further clarified that these liquids with the higher flashpoints belong to § 1910.107 and are not part of GHS Category 4 (Document ID #0497 Tr. 68).

In addition, Intercontinental Chemical Corporation recommended that OSHA create six new categories matching the six classes in the original § 1910.106 (Document ID #0500). The Agency believes that this approach would be inconsistent with GHS, since the GHS classifications and categories, including flammable liquid Categories 1–4, were established by international committees and are in place. OSHA's intent in this rulemaking is to harmonize the HCS with the existing GHS classifications and categories, not to make new categories.

In summary, OSHA views this rulemaking as a step towards eliminating current inconsistencies. OSHA believes the potential confusion with other agency policies, standards, consensus standards, and traditional practices suggested by the commenters are not likely to occur for several reasons. First, the changes in the final rule will bring internal consistency to the OSHA standards covered. OSHA standards currently have several cut-off values for flammable and combustible liquids. In OSHA's general industry standard (§ 1910.106), 100 °F is the cut-off between the flammable and combustible liquids, but in construction, § 1926.155, 140 °F is the cut-off between flammable and combustible. Harmonizing these standards, which have been out of sync for many years, will bring needed consistency to the safety standards. In addition, as noted above, substantive requirements have not changed, and therefore designs are not affected.

Second, the changes to the standards do not require changes in work practices. Rather, what have changed are a few regulatory terms used in the standards. Commenters who thought that such changes in definitions and terminology would result in significant and costly modifications to facility design and operation are incorrect, as the old requirements in the standards remain and no facility design and operation changes are required (Document ID #0344, 0381, and 0399). The requirements for what were known formerly as combustible liquids remain the same even though they are now categorized as flammable liquids.

Third, there is growing awareness of the GHS "flammable liquids" definition. Other agencies, such as DOT, are already aligned with the GHS definition for flammable liquids (49 CFR 173.120), and OSHA believes that its ANPR and NPRM have raised awareness of the definition.

Change occurs in every area of employment, and employers and workers get trained and adjust to the change; OSHA believes these minor changes will be accepted and adopted. OSHA's flammable and combustible liquid storage requirements have always been based on the flashpoint and boiling point of the liquid; OSHA does not

believe that facility designs rely on whether the liquid is labeled as flammable or combustible. (*See* Document ID #0497 Tr. 84–85) Thus, OSHA has concluded that the allegations of impacts on facility design and operations are perceptual rather than actual. This is especially true in light of the fact that certain OSHA standards were exempted from the terminology changes if these changes were to affect internal design criteria of any area of the workplace. OSHA has therefore concluded that the proposed changes to the § 1910.106 definitions are reasonably necessary and appropriate and has carried them forward into the final rule.

OSHA will be doing outreach to affected parties and working with professional and trade associations to help users become familiar with and competent in applying these modifications. ORC testified that the changes may cause confusion to workers familiar with NFPA nomenclature, and agreed with OSHA that, with training, any confusion resulting from the change from NFPA definitions and terminology to GHS definitions and terminology would be overcome. ORC (Document ID #0494 Tr. 100–101) further stated that potential confusion would not be a reason to delay moving forward with finalizing the standard:

> There's a significant problem with lack of harmonization of chemical control approaches in the United States, and we would like to see, as we said in our testimony, some sort of formalization because we think it's the only thing that's going to work here, formalization of regular contacts between the NFPA and OSHA.

Mike Wright, representing the United Steelworkers (Document ID #0494 Tr. 76–77), put it succinctly, stating:

> The whole point of harmonization is to reconcile different standards, which may be conflicting. That means something has to change. * * * Ultimately, in the short term will there be some confusion? Yes. Can we minimize that through good training, through good information? Yes, and we ought to, but ultimately I think we have a globally harmonized system that's been adopted on a worldwide level and then we have various national organizations—very important ones like the NFPA—which may deviate in the way they communicate hazards from that globally harmonized system.
> With respect to my friends at the NFPA, who I think do wonderful work, I think their job is to harmonize their system to the Globally Harmonized System. We hope that happens as soon as possible, and I'm confident that it will.
> You know, ultimately we need to go to one * * * system worldwide. We have that system now. It will take some time and a little bit of confusion to conform every other kind of national voluntary system to that, but that work has to be done.

OSHA agrees and believes users of the new GHS flammable liquid categories will implement its new terminology in their work.

Minor Safety Standard Changes

The note in the PSM construction standard, § 1926.64(d)(1)(vii), has been changed. In the current standard, paragraph (d)(1)(vii), the note states, "Material Safety Data Sheets meeting the requirements of 29 CFR 1926.59(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph." The note has been changed to "Safety Data Sheets (SDSs) meeting the requirements of 29 CFR 1910.1200(g) . * * *"

To correct a technical error and to complete alignment across standards, § 1910.106(j), Scope, has been made consistent with § 1910.106(a)(19) and § 1910.1200, Appendix B. Proposed § 1910.106(j) stated that it "applie[d] to the handling, storage, and use of flammable liquids with a flashpoint *below* 199.4 °F (93 °C) unless otherwise noted." (Emphasis added). Final § 1910.106(j) is now consistent with § 1910.106(a)(19) and § 1910.1200 in that it applies to "* * * flammable liquids with a flashpoint *at or below* 199.4 °F (93 °C) * * *" (Emphasis added).

In § 1926.155, OSHA proposed to harmonize the definitions of flammable and combustible liquids to be consistent with the GHS categories of flammable liquids (*i.e.*, the updating of the definition of flammable liquids and the removal of the definition for combustible liquids), and this change is carried through to the final rule. The final rule also removes "or combustible" in the other standards in Subpart F, to maintain consistency with the "Definitions" in § 1926.155. In § 1926.150(c)(vi), which currently states, "A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite," the term "or combustible" has been removed. Likewise, the Agency is correcting § 1926.151(b)(3) by removing "or combustible." In § 1926.151(a)(4), Portable battery powered lighting, which states that "the storage, handling, or use of flammable gases or liquids, shall be * * * approved for the hazardous locations," the term "flammable liquids" has been changed to "Category 1, 2, or 3 flammable liquids." This change maintains the scope set by the flashpoint ranges for the Subpart (as defined by the original § 1926.155 paragraphs (c) and (h)).

The Soap and Detergent Association and Consumer Specialty Products Association, in a joint comment (Document ID #0344), suggested that OSHA change the term "pilot light" to "indicating light." As discussed previously, this type of change is outside of the scope of this rulemaking since it does not pertain to hazard communication or GHS harmonization. Therefore, OSHA is not adopting that suggestion at this time.

Methods To Determine Flashpoints

OSHA proposed to update the methods that may be used to determine flashpoints in the NPRM. These methods include updated ASTM methods, ISO methods, and British, French, and German national standards for the testing. The methods are listed in Appendix B.6 of § 1910.1200 and are also referenced in Revision 3 of the GHS (2009), Chapter 2.6.

In the definitions of § 1910.106, the current standard allowed only ASTM D–56–70 and ASTM D–93–71 as testing methods to determine flashpoints. In § 1926.155, which applies to Subpart F of the construction standards (Fire Protection and Prevention), OSHA currently allows only ASTM D–56–69 and ASTM D–93–69 for such determinations. The current HCS allows only ASTM D 56–79, ASTM D 93–79, and ASTM D 3278–78. The methods allowed in § 1910.155 were adopted in the late 1960s, and the methods for § 1910.106 and § 1926.1200 were adopted in the 1970s.

The NPRM updated the methods in § 1910.1200 to conform to the GHS. However, flashpoint methods in § 1910.1200 had always differed from methods in § 1910.106 and § 1926.155. Instead of revamping the older test methods in OSHA's other standards, the proposal allowed a broader test selection. OSHA kept the tests currently permitted in § 1910.106 and § 1926.155 because they were in the original OSHA standards, but allowed methods in the GHS-modified HCS be used as well. The final rule adopts these changes.

Thus, the final rule amends § 1910.106 and § 1926.155 to allow ASTM D–56–70 and ASTM D–93–71 for § 1910.106; ASTM D–56–69 and ASTM D–93–69 for § 1910.155; and the equivalent testing methods permitted in the HCS, § 1910.1200, Appendix B.6, Physical Hazard Criteria. For example, as amended by the final rule, § 1910.106(a)(14)(i) states that for a liquid which has a viscosity of less than 45 SUS at 100 °F (37.8 °C), does not

contain suspended solids, and does not have a tendency to form a surface film while under test, the procedure specified in the Standard Method of Test for Flashpoint by Tag Closed Tester (ASTM D–56–70), which is incorporated by reference as specified in § 1910.6, or an equivalent test method as defined in Appendix B to § 1910.1200—Physical Hazard Criteria, must be used.

By equivalent test method, OSHA means employers can select any of the test methods in Appendix B.6 or in Chapter 2.6 of Revision 3 of the GHS (2009).

The only comments on this issue recommended additional methods for determining flashpoints (Document ID #0344 and 0381). The Soap and Detergent Association/Consumer Specialty Products Association (Document ID #0344) and the Procter & Gamble Company (Document ID #0381) recommended OSHA include ASTM D6450 on the list of approved methods for determining the flashpoints of liquids in the "incorporation by reference" list in § 1910.106. OSHA is not prepared to adopt this method at this time. The determination of flashpoint test methods for GHS falls under a Sub-committee of the United Nations Economic and Social Council's Committee of Experts on the Transport of Dangerous Goods (UNCEDTG). Commenters who wish the GHS to incorporate ASTM D6450 should direct their requests to that body, and if the method is incorporated into the GHS, OSHA will consider the matter at that time.

Flammable Aerosols

OSHA currently defines the term "flammable aerosol" in § 1910.106 and in § 1910.1200 by reference to a definition developed by the Consumer Product Safety Commission under the Federal Hazardous Substances Act. *See* 16 CFR 1500.45; *See also* 15 U.S.C. 1261(l). The current HCS defines flammable aerosol as an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.

The current § 1910.106 definitions for "aerosol" and "flammable aerosol" are provided in (§ 1910.106(a)(1)) and (§ 1910.106(a)(13)) and are different from those in the revised Hazard Communication Standard. In the current § 1910.106, an aerosol is defined as a material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure. However, in the current § 1910.106, a flammable aerosol is defined as an aerosol which is required to be labeled "Flammable" under the Federal Hazardous Substances Labeling Act (15 U.S.C. 1261). For the purposes of § 1910.106(d), such aerosols are considered Class IA liquids.

OSHA proposed to remove the definitions of "aerosol" and "flammable aerosol" from § 1910.106 and instead insert its GHS-consistent definitions along with references to Appendix B.3 of the GHS-modified HCS. In response to OSHA's proposed action, National Paint and Coatings Association and Alliance of Hazardous Materials Professionals both said that, while they were not prepared to offer specific impact information on operations, "to align OSHA definitions for * * * Flammable Aerosols is fully consistent with the concept of a 'single world-wide' definition for these hazards." (Document ID #0313 and 0327).

OSHA agrees with these comments and has included the revised definition of "flammable aerosols" in the final rule. The revised definition in the Flammable liquids standard, § 1910.106, duplicates the flammable aerosols definition contained in Appendix B to § 1910.1200—Physical Hazard Criteria. For the purposes of § 1910.106(d), such aerosols are considered Category 1 flammable liquids.

The GHS-modified definition and classification criteria for flammable aerosols can be found in Appendix B.3 of HCS.

OSHA's decision to change the definition of aerosols to be consistent with the GHS-modified HCS is based not only upon harmonizing its own standards with those followed by other countries who have or are considering adopting GHS, but also to harmonize with DOT's definition for flammable aerosols, which is also consistent with the GHS. *See* 49 CFR 173.115(k).

Dr. Michelle Sullivan (Document ID #0382), alluding to flammable aerosols, pointed out that flammable categories will differ among regulatory authorities. She stated:

> [T]he GHS flammable aerosol criteria are linked to the criteria for flammable liquid, flammable solid and flammable gas, the flammable aerosol criteria depend on the hazard categories/building blocks of these other hazards * * * some regulatory authorities will adopt categories 1–4 while others will adopt categories 1–3 * * * [and thus] * * * the flammable aerosol criteria will differ for these regulatory authorities.

Regarding Dr. Sullivan's comment, OSHA acknowledges that other regulatory bodies, when adopting GHS, may choose different building blocks. However, the basis for classification will still be based on the same criteria and will lead to harmonization of similarly covered materials. This does not affect OSHA's decision to strive for both domestic and international harmonization.

Finally, OSHA believes that the GHS classification criteria are similar enough to the current § 1910.106 and § 1910.1200 criteria that all aerosols currently regulated by OSHA would continue to be so, and that few, if any, new aerosols would be subject to OSHA regulation. Indeed, OSHA raised this issue in the NPRM and received no comments to the contrary.

Standards Not Included in This Rulemaking

OSHA did not propose to change standards that incorporate by reference other consensus standards, such as NFPA codes, or are based on consensus standards when those consensus standards are used for internal design criteria only and do not reference the HCS for applicable scope or incorporation into the SDS. These standards include Subpart S—Electrical, in Part 1910 (General Industry), and Subpart K—Electrical, in Part 1926 (Construction). Many commenters on the ANPR were particularly concerned that a change in OSHA's definitions would create an incompatibility with local building codes (Document ID #0047, 0075, 0076, 0104, 0113, 0145 and 0163). They alleged that, in many cases, this would require extensive rewiring to meet the Subpart S requirements on hazardous locations and would lead to conflicts with local electrical codes.

Many commenters on the NPRM supported OSHA's exemption of these standards (Document ID #0328, 0330, 0336, 0370, 0393, and 0408). Ameren expressed concern that if OSHA harmonized the electrical and blasting agents standards (Part 1910 Subpart S, § 1910.109, and Part 1926 Subpart K, § 1926.914) with the GHS, such changes would require training of affected employees on the changes (Document ID #0330). ASSE agreed with OSHA's decision not to propose updates to the electrical standards (general industry 1910 Subpart S and construction 1926 Subpart K) or explosives and blasting agents (general industry § 1910.109 and construction § 1926.914), since these subparts are "self-contained" in that they do not rely on other OSHA standards for regulatory scope or definitions but reference external organizations such as the National Fire Protection Association (NFPA) (Document ID #0336). The American Iron and Steel Institute agreed (Document ID #0408). ORC strongly

supported OSHA's approach of not updating these standards but waiting until the referenced external organizations adopted the GHS elements (Document ID #0370).

Wacker Chemical Company, PRR, and ACC urged OSHA to update electrical and explosive and blasting agents standards if the consensus organizations could come to agreement, and they expressed their concerns regarding potential conflicts with local codes and regulations (Document ID #0335, 0339, and 0393). Wacker Chemical Corporation encouraged OSHA to work closely with organizations (NFPA and others) that develop fire and electrical codes to ensure there is consistent application of these codes to area classification, building construction, equipment electrical ratings, etc. (Document ID #0335). Wacker Chemical suggested that OSHA could make progress with the consensus organizations (Document ID #0335). PRR recommended harmonization updates of electrical and explosive standards if the updates would enhance safety and the ease of doing business in the global market (Document ID #0339). The ACC agreed with OSHA's decision not to change standards that incorporate consensus standards by reference (*i.e.*, design criteria) (Document ID #0393). ACC requested OSHA clarify in its final rule that harmonization would not affect the International Building Code and the International Fire Code such that users will not be unduly required to upgrade buildings to conform to requirements for hazardous occupancies. By its decision regarding standards not included in this rulemaking, OSHA is making it clear that upgrading buildings is not within the scope of this rulemaking.

OSHA agrees with those comments that expressed the desire to harmonize but also expressed concern over the potential effects of internal codes. OSHA concluded that exempting those standards where conflicts with internal codes could occur at this time was appropriate. OSHA agrees with ACC that impacting electrical area classification, facility siting, and wiring configuration is not appropriate. Therefore, because of these potential conflicts with internal design criteria, OSHA is not harmonizing the electrical and other standards that depend on internal design criteria and local building codes.

Explosives and Blasting Agents

OSHA did not propose to harmonize the Explosive and Blasting Agents standards, § 1910.109 (general industry) and § 1926, Subpart U (construction). At the time of the proposal, a separate rulemaking to revise them was in progress. That rulemaking has since been terminated (75 FR 5545, Feb. 3, 2010). However, the HCS has always covered hazardous chemicals regulated by OSHA's Explosive and Blasting Agents standards. Although the rulemaking on explosives and blasting agents has ceased, the general requirements in the GHS-modified HCS and specific requirements in its appendices still apply to explosives and blasting agents that can be considered hazardous chemicals. Manufacturers and importers must evaluate chemicals to classify their health and physical hazards in accordance with paragraph (d) of the HCS, must affix labels in accordance with paragraph (f) in HCS, and must provide SDSs in accordance with paragraph (g) of the HCS. Appendix B.1 of the GHS-modified HCS contains specific classification criteria for explosives. Furthermore, labels are required by the Department of Transportation (DOT) for the transportation of packages or containment devices that contain hazardous materials meeting one or more of DOT's hazard class definitions. *See* 49 CFR Part 172 Subpart E. In addition, OSHA's general industry standard § 1910.1201, "Retention of DOT markings, placards, and labels," requires that DOT labels, placards, or markings be retained under certain conditions. Thus, explosives and blasting agents are already covered by the GHS-modified HCS and § 1910.1201.

The few commenters who addressed the issue supported OSHA's decision not to include the Explosive and Blasting Agents standards (§ 1910.109 and § 1926.914) in the proposal (Document ID #0328, 0330, 0336, 0362, and 0370).

As to the continuing coverage of HCS, a representative from Institute Makers of Explosives stated that the commercial explosives industry understands the importance of GHS, has been prepared for several years to implement GHS, and would not experience any impacts to explosives operations that were not already anticipated (Document ID #0362).

Galaxy Fireworks noted that § 1910.109(k)(1) excludes the sale and "use (public display)" of pyrotechnics (fireworks) from the explosives standard (Document ID #0355). Galaxy Fireworks' concern was the potential for the proposal to create a regulation that overlaps with the existing requirements of the Department of Transportation and the Consumer Product Safety Commission. Galaxy urged OSHA to work with these other agencies in amending the HCS to develop regulations that would apply uniformly to the fireworks industry and with other organizations to further harmonization (Document ID #0335). OSHA agrees and believes its global harmonization efforts embodied in this rulemaking go a long way toward the overall goal of consistency.

Maritime

OSHA received one comment, from Northrop Grumman Shipbuilding, which stated that OSHA had omitted modification of the shipyard Part 1915 safety standards for GHS harmonization (Document ID # 0395). More specifically, Northrop Grumman believed that the maritime standards that contain requirements for flammable and combustible liquids required review and updating to be GHS harmonized, just as the flammable and combustible liquids the General Industry Part 1910 and Construction Part 1926 standards were proposed to be reviewed and updated.

OSHA did not propose to update the maritime standards, other than the substance-specific standards mentioned above, in this rulemaking. Unlike the standards in general industry and construction, the maritime standards (Shipyard Employment, Part 1915; Marine Terminals, Part 1917; and Longshoring, Part 1918) have always addressed flammables and combustibles in their own unique way, reflecting the special conditions of maritime work. These parts do not use flashpoint criteria to distinguish between flammable and combustible liquids. The terminology in the maritime standards that addresses flammable and combustible materials, including liquids, differs from the general industry and construction standards. For example, § 1915.12(b)(1) (Flammable atmospheres) and § 1915.54 (Welding, cutting and heating of hollow metal containers not covered by § 1915.12) require competent-person testing and contain detailed instructions on the specific maritime work covered.

There are a few paragraphs in the maritime standards where flammable and combustible liquids requirements reference flashpoint criteria but in these cases, flashpoints are not used for the purpose of distinguishing flammable from combustible liquids. Examples include Subpart P, Fire Protection, § 1915.501 through § 1915.509, where flammable liquid is defined as liquids with flashpoints below 100 °F (37.8 °C). Combustible liquids are neither defined nor mentioned in this Subpart, although combustible materials are mentioned and not defined. Other maritime standards such as § 1915.14 (Hot work)

and § 1915.35 (Painting) specify flashpoints for certain requirements, but these are not distinctions of flashpoints defining flammable or combustible liquids. The final rule does not modify these criteria.

OSHA has issued a maritime compliance tool, "Tool Bag Directive for the Part 1915 Shipyard Employment Standards," that includes specific interpretations of the maritime standards. The Tool Bag Directive references specific general industry standards in order to provide further guidance related to some of the more general maritime requirements. A specific case is how general industry standard § 1910.106 is used. The Tool Bag Directive informs users that if specific Part 1915 shipyard requirements give flashpoint criteria, those requirements take precedence. However, where definitions of flammable and combustible liquids are not specified in the Part 1915 shipyard standards, the definitions of § 1910.106 are to apply. The final rule's changes do not significantly modify the substantive requirements of § 1910.106, and the Tool Bag Directive's interpretive policy will continue after the final rule becomes effective, using the new definitions in § 1910.106.

In a similar manner, OSHA has a compliance tool for Parts 1917 "Marine Terminals" and 1918 "Longshoring" called the Tool Shed Directive. This Directive notes that the requirements of § 1910.1200 apply to operations covered by Parts 1917 and 1918. *See also* 1917.1(a)(2)(vi); 1918.1(b)(4). Therefore, all the requirements in the GHS-modified HCS (§ 1910.1200), and its appendices will apply to the maritime industry. In addition, part 1910 applies to marine terminal operations that fall within the exception found at § 1917.1(a)(1)(i): "facilities used solely for the bulk storage, handling, and transfer of flammable, non-flammable, and combustible liquids and gases." The final rule's changes to § 1910.106 will therefore apply to facilities handling flammable and combustible liquids that fall within this exclusion, but again, as explained above, the substantive requirements of § 1910.106 have not changed significantly.

Construction

The Building and Construction Trades Department (BCTD) requested that OSHA clarify inconsistencies in the construction standards, particularly by updating the Part 1926 standards to conform to the proposed requirements for and definitions of "flammable" and the related deletion of the term "combustible" liquids (Document ID # 0359). BCTD gave examples of §§ 1926.152, 1926.155, 1926.66 and Subpart K of Part 1926 and requested that OSHA conduct a thorough review of the Part 1926 construction standards. Though it had done so once in preparing the NPRM, OSHA again conducted a thorough review of Part 1926. OSHA had already proposed to modify § 1926.152 (Flammable and combustible liquids) and § 1926.155 (Definitions) as well as § 1926.64 (Process Safety Management), § 1926.65 (HAZWOPER), and the substance-specific health standards in construction in the NPRM. As explained above, OSHA has made further revisions in the construction regulations regarding process safety management (§ 1926.64(d)(1)(vii)) and fire protection and prevention (§ 1926.150(c)(vi), § 1926.151(a)(4)), and § 1926.151(b)(3)) in this final rule.

Like Subpart S in general industry, § 1926.66 (Criteria for design and construction of spray booths) belongs to the category of construction standards that incorporate other consensus standards by reference, such as NFPA codes, or are based on consensus standards when those consensus standards are used for internal design criteria only and do not reference HCS for applicable scope or incorporation into the SDS. Clearly, there is no reason to change the terminology in § 1926.66. As noted above, Part 1926, Subpart K (Electrical), belongs in this category. Other similar standards are § 1926.351 (Arc Welding and Cutting), and Part 1926, Subpart V (Power Transmission and Distribution). OSHA is not modifying these standards for the same reasons listed above for general industry.

Similar to the discussion regarding the Maritime standards, OSHA did not propose modifications of standards that do not contain definitions that are applicable to standards in the Subpart or explicitly reference standards that contain the definitions. The standards may contain phrases with the terms "flammable liquid" or "combustible liquid," but the definitions of the terms are absent. Standards belonging to this category of undefined terms include § 1926.66(c)(9)(i) (Criteria for design and construction of spray booths), § 1926.252(e) (Disposal of waste materials), § 1926.307(p)(2)(ii) (Mechanical power-transmission apparatus), § 1926.352(c) and (h) (Fire prevention), § 1926.803(l)(13) (Compressed air), and § 1926.1101, Appendix B (Sampling and Analysis for Asbestos). In addition, some of these standards' requirements use the term "flammable liquid" without the term "combustible liquid," and some of the requirements use the term "combustible liquid" without the term "flammable liquid." As with the maritime standards, since OSHA has not changed the actual requirements of § 1910.106 or § 1926.155, OSHA does not anticipate that the final rule will affect the requirements of other OSHA standards that use some of the same terminology.

In addition, OSHA did not modify standards that refer to flammable and combustible materials, storage piles, etc. that are not liquids. Examples are § 1926.550(a)(15)(vii)(C) (Cranes and derricks), which refers to combustible and flammable materials; § 1926.956(b)(3) (Underground lines), which refers to combustible gases; and § 1926.352(c) (Fire prevention), which refers to flammable compounds. In addition, § 1926.154(e)(1) (Temporary heating devices) mentions "flammable liquids," but the term was not the focus of the standard. The requirement mentions flammable liquid-fired heaters, but the focus is on safety controls for the particular piece of equipment. Safety training and education, § 1926.21(b)(5), is another example that contains some of the terminology, but its focus is on safety training. Flammable liquids are treated in a general sense, *i.e.*, grouped with gases or toxic materials.

Miscellaneous

A commenter from the International Chemical Workers Union Council recommended OSHA include a conversion formula for Centigrade and Fahrenheit or, at a minimum, provide the equivalent degrees when addressing flammable and combustible liquids, since in general employers and employees in the U.S. are more familiar with degrees Fahrenheit (Document ID # 456). OSHA proposed to provide temperature equivalents, and in the final standard equivalents are included where there are requirements for flammable and combustible liquids. The formulas for conversion are:

$(9/5)\ °C + 32 = °F$ or $(5/9)(°F-32) = °C$

Since the formulas for conversion are standard formulas found in textbooks, and since equivalents have been provided wherever possible for flammable and combustible liquids, OSHA has determined that it is not necessary to state the formulas for conversion in the actual regulations.

XIV. Authority and Signature

This document was prepared under the direction of David Michaels, Assistant Secretary of Labor for Occupational Safety and Health, U.S.

Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210. It is issued under the authority of sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); 5 U.S.C. 553; Section 304, Clean Air Act Amendments of 1990 (Pub. L. 101–549, reprinted at 29 U.S.C.A. 655 Note); Section 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Section 107, Contract Work Hours and Safety Standards Act (40 U.S.C. 3704); Section 1031, Housing and Community Development Act of 1992 (42 U.S.C. 4853); Section 126, Superfund Amendments and Reauthorization Act of 1986, as amended (reprinted at 29 U.S.C.A. 655 Note); Secretary of Labor's Order No. 1–2012 (77 FR 3912); and 29 CFR Part 1911.

List of Subjects

29 CFR Part 1910

Asbestos, Blood, Chemicals, Diving, Fire prevention, Gases, Hazard communication, Hazardous substances, Health records, Incorporation by reference, Labeling, Labels, Laboratories, Occupational safety and health, Reporting and recordkeeping requirements, Safety data sheets, Signs and symbols, and Training.

29 CFR Part 1915

Hazard communication, Hazardous substances, Labels, Longshore and harbor workers, Occupational safety and health, Reporting and recordkeeping requirements, Safety data sheets, Signs and symbols, Training, and Vessels.

29 CFR Part 1926

Chemicals, Construction industry, Diving, Fire prevention, Gases, Hazard communication, Hazardous substances, Health records, Labels, Lead, Occupational safety and health, Reporting and recordkeeping requirements, Safety data sheets, Signs and symbols, and Training.

Signed at Washington, DC, on February 23, 2012.

David Michaels,

Assistant Secretary of Labor for Occupational Safety and Health.

Final Amendments

For the reasons discussed in the preamble, the Occupational Safety and Health Administration amends 29 CFR parts 1910, 1915 and 1926 as set forth below:

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Subpart A—[Amended]

■ 1. Revise the authority citation for subpart A of part 1910 to read as follows:

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355) or 1–2012 (77 FR 3912), as applicable.

Section 1910.6 also issued under 5 U.S.C. 553. Sections 1910.6, 1910.7, and 1910.8 also issued under 29 CFR Part 1911. Section 1910.7(f) also issued under 31 U.S.C. 9701, 29 U.S.C. 9a, 5 U.S.C. 553; Pub. L. 106–113 (113 Stat. 1501A–222); Pub. L. 111–8 and 111–317 and OMB Circular A–25 (dated July 8, 1993) (58 FR 38142, July 15, 1993).

■ 2. Amend § 1910.6 by revising paragraphs (a)(4) and (h), the introductory text of paragraph (q), and by adding new paragraphs (q)(37), (y), and (z) to read as follows:

§ 1910.6 Incorporation by reference

(a) * * *

(4) Copies of standards listed in this section and issued by private standards organizations are available for purchase from the issuing organizations at the addresses or through the other contact information listed below for these private standards organizations. In addition, these standards are available for inspection at any Regional Office of the Occupational Safety and Health Administration (OSHA), or at the OSHA Docket Office, U.S. Department of Labor, 200 Constitution Avenue NW., Room N–2625, Washington, DC 20210; telephone: 202–693–2350 (TTY number: 877–889–5627). They are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of these standards at NARA, telephone: 202–741–6030, or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.*

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(h) Copies of the standards listed below in this paragraph (h) are available for purchase from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428–2959; Telephone: 610–832–9585; Fax: 610–832–9555; Email: *seviceastm.org;* Web site: *http://www.astm.org.* Copies of historical standards or standards that ASTM does not have may be purchased from Information Handling Services, Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112; Telephone: 1–800–854–7179; Email: *global@ihs.com;* Web sites: *http://global.ihs.com* or *http://www.store.ihs.com.*

(1) ASTM A 47–68, Malleable Iron Castings, IBR approved for § 1910.111.

(2) ASTM A 53–69, Welded and Seamless Steel Pipe, IBR approved for §§ 1910.110 and 1910.111.

(3) ASTM A 126–66, Gray Iron Casting for Valves, Flanges and Pipe Fitting, IBR approved for § 1910.111.

(4) ASTM A 391–65 (ANSI G61.1–1968), Alloy Steel Chain, IBR approved for § 1910.184.

(5) ASTM A 395–68, Ductile Iron for Use at Elevated Temperatures, IBR approved for § 1910.111.

(6) ASTM B 88–66A, Seamless Copper Water Tube, IBR approved for § 1910.252.

(7) ASTM B 88–69, Seamless Copper Water Tube, IBR approved for § 1910.110.

(8) ASTM B 117–64, Salt Spray (Fog) Test, IBR approved for § 1910.268.

(9) ASTM B 210–68, Aluminum-Alloy Drawn Seamless Tubes, IBR approved for § 1910.110.

(10) ASTM B 241–69, Standard Specifications for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube, IBR approved for § 1910.110.

(11) ASTM D 5–65, Test for Penetration by Bituminous Materials, IBR approved for § 1910.106.

(12) ASTM D 56–70, Test for Flash Point by Tag Closed Tester, IBR approved for § 1910.106.

(13) ASTM D 56–05, Standard Test Method for Flash Point by Tag Closed Cup Tester, Approved May 1, 2005, IBR approved for Appendix B to § 1910.1200.

(14) ASTM D 86–62, Test for Distillation of Petroleum Products, IBR approved for §§ 1910.106 and 1910.119.

(15) ASTM D 86–07a, Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure, Approved April 1, 2007, IBR approved for Appendix B to § 1910.1200.

(16) ASTM D 88–56, Test for Saybolt Viscosity, IBR approved for § 1910.106.

(17) ASTM D 93–71, Test for Flash Point by Pensky Martens, IBR approved for § 1910.106.

(18) ASTM D 93–08, Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester, Approved Oct. 15, 2008, IBR approved for Appendix B to § 1910.1200.

(19) ASTM D 240–02 (Reapproved 2007), Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter, Approved May 1, 2007, IBR approved for Appendix B to § 1910.1200.

(20) ASTM D 323–68, Standard Test Method of Test for Vapor Pressure of Petroleum Products (Reid Method), IBR approved for § 1910.106.

(21) ASTM D 445–65, Test for Viscosity of Transparent and Opaque Liquids, IBR approved for § 1910.106.

(22) ASTM D 1078–05, Standard Test Method for Distillation Range of Volatile Organic Liquids, Approved May 15, 2005, IBR approved for Appendix B to § 1910.1200.

(23) ASTM D 1692–68, Test for Flammability of Plastic Sheeting and Cellular Plastics, IBR approved for § 1910.103.

(24) ASTM D 2161–66, Conversion Tables for SUS, IBR approved for § 1910.106.

(25) ASTM D 3278–96 (Reapproved 2004) E1, Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus, Approved November 1, 2004, IBR approved for Appendix B to § 1910.1200.

(26) ASTM D 3828–07a, Standard Test Methods for Flash Point by Small Scale Closed Cup Tester, Approved July 15, 2007, IBR approved for Appendix B to § 1910.1200.

(27) ASTM F–2412–2005, Standard Test Methods for Foot Protection, IBR approved for § 1910.136.

(28) ASTM F–2413–2005, Standard Specification for Performance Requirements for Protective Footwear, IBR approved for § 1910.136.

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(q) The following material is available for purchase from the National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269; Telephone: 800–344–3555 or 617–770–3000; Fax: 1–800–593–6372 or 1–508–895–8301; Email: *custserv@nfpa.org;* Web site: *http://www.nfpa.org.*

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(37) NFPA 30B, Code for the Manufacture and Storage of Aerosol Products, 2007 Edition, Approved August 17, 2006, IBR approved for Appendix B to § 1910.1200.

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(y)(1) The following materials are available for purchase from the International Standards Organization (ISO) through ANSI, 25 West 43rd Street, Fourth Floor, New York, NY 10036–7417; Telephone: 212–642–4980; Fax: 212–302–1286; Email: *info@ansi.org;* Web site: *http://www.ansi.org.*

(2) Documents not available in the ANSI store may be purchased from:

(i) Document Center Inc., 111 Industrial Road, Suite 9, Belmont, 94002; Telephone: 650–591–7600; Fax: 650–591–7617; Email: *info@document-center.com; Web site: www.document-center.com.*

(ii) DECO—Document Engineering Co., Inc., 15210 Stagg Street, Van Nuys, CA 91405; Telephone: 800–645–7732 or 818–782–1010; Fax: 818–782–2374; Email: *doceng@doceng.com;* Web site: *www.doceng.com*

(iii) Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112; Telephone: 1–800–854–7179 or 303–397–7956; Fax: 303–397–2740; Email: *global@ihs.com;* Web sites: *http://global.ihs.com* or *http://www.store.ihs.com;*

(iv) ILI Infodisk, Inc., 610 Winters Avenue, Paramus, NJ 07652; Telephone: 201–986–1131; Fax: 201–986–7886; Email: *sales@ili-info.com;* Web site: *www.ili-info.com.*

(v) Techstreet, a business of Thomson Reuters, 3916 Ranchero Drive, Ann Arbor, MI 48108; Telephone: 800–699–9277 or 734–780–8000; Fax: 734–780–2046; Email: *techstreet.service@thomsonreuters.com;* Web site: *www.Techstreet.com.*

(3) ISO 10156:1996 (E), Gases and Gas Mixtures—Determination of Fire Potential and Oxidizing Ability for the Selection of Cylinder Valve Outlets, Second Edition, Feb. 15, 1996, IBR approved for Appendix B to § 1910.1200.

(4) ISO 10156–2:2005 (E), Gas cylinders—Gases and Gas Mixtures—Part 2: Determination of Oxidizing Ability of Toxic and Corrosive Gases and Gas Mixtures, First Edition, Aug. 1, 2005, IBR approved for Appendix B to § 1910.1200.

(5) ISO 13943:2000 (E/F), Fire Safety—Vocabulary, First Edition, April, 15, 2000, IBR approved for Appendix B to § 1910.1200.

(z)(1) The following document is available for purchase from United Nations Publications, Customer Service, c/o National Book Network, 15200 NBN Way, PO Box 190, Blue Ridge Summit, PA 17214; telephone: 1–888–254–4286; fax: 1–800–338–4550; email: *unpublications@nbnbooks.com.* Other distributors of United Nations Publications include:

(i) Bernan, 15200 NBN Way, Blue Ridge Summit, PA 17214; telephone: 1–800–865–3457; fax: 1–800–865–3450; email: *customercare@bernan;* Web site: *http://www.bernan.com;* and

(ii) Renouf Publishing Co. Ltd., 812 Proctor Avenue, Ogdensburg, NY 13669–2205; telephone: 1–888–551–7470; Fax: 1–888–551–7471; email: *orders@renoufbooks.com;* Web site: *http://www.renoufbooks.com.*

(2) UN ST/SG/AC.10/Rev.4, The UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Fourth Revised Edition, 2003, IBR approved for Appendix B to § 1910.1200.

Subpart H—[Amended]

■ 3. The authority citation for subpart H is revised to read as follows:

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), or 5–2007 (72 FR 31159), 4–2010 (75 FR 55355) or 1–2012 (77 FR 3912), as applicable; and 29 CFR part 1911.

Sections 1910.103, 1910.106 through 1910.111, and 1910.119, 1910.120, and 1910.122 through 1910.126 also issued under 29 CFR part 1911.

Section 1910.119 also issued under Section 304, Clean Air Act Amendments of 1990 (Pub. L. 101–549), reprinted at 29 U.S.C.A. 655 Note.

Section 1910.120 also issued under Section 126, Superfund Amendments and Reauthorization Act of 1986 as amended (29 U.S.C.A. 655 Note), and 5 U.S.C. 553.

■ 4. Amend § 1910.106 as follows:

■ A. Revise the section heading;

■ B. Revise paragraphs (a)(13), (a)(14)(i) through (a)(14)(iii), and (a)(19);

■ C. Remove the last sentence of paragraph (a)(17);

■ D. Remove and reserve paragraph (a)(18);

■ E. Remove the words "or combustible" wherever they appear in § 1910.106.

■ F. Remove the words "and combustible" in paragraphs (d)(5)(vi) introductory text, (e)(2) introductory text, (j)(1) and (j)(3);

■ G. Revise paragraphs (b)(2)(iv)(*f*) and (*g*), (b)(2)(vi)(*b*), (b)(2)(viii)(*e*), (b)(3)(i), (b)(3)(iv)(*a*), (b)(3)(iv)(*c*), (b)(3)(v)(*d*), and (b)(4)(iv)(*e*);

■ H. Revise paragraphs (d)(1)(ii)(*b*), (d)(2)(iii) introductory text and (d)(2)(iii)(*a*)(*2*), Table H–12, paragraphs (d)(3)(i), (d)(4)(iii), (d)(4)(iv), Tables H–14 through H–17, and paragraph (d)(7)(i)(*b*);

■ I. Revise paragraphs (e)(2)(ii)(*b*)(*1*), (e)(2)(ii)(*b*)(*2*), (e)(2)(ii)(*b*)(*3*), (e)(2)(iv)(*a*), (e)(2)(iv)(*c*), (e)(3)(v)(*a*), (e)(3)(v)(*b*), (e)(4)(i), (e)(6)(ii), and (e)(7)(i)(*c*);

■ J. Revise paragraphs (f)(1)(i), (f)(1)(ii), (f)(2)(ii), (f)(2)(iii)(*a*), (f)(2)(iii)(*b*), (f)(2)(iii)(*c*), (f)(3)(i), (f)(3)(ii), (f)(3)(iv)(*a*)(*1*), (f)(3)(iv)(*a*)(*2*), (f)(3)(iv)(*d*)(*2*), (f)(3)(v), (f)(3)(vi), (f)(4)(viii)(*e*), (f)(5)(i), (f)(6), and (f)(8);

■ K. Revise paragraphs (g)(1)(i)(*c*), (g)(1)(i)(*e*) introductory text, (g)(1)(i)(*f*), (g)(1)(iii)(*a*), (g)(1)(iii)(*b*), (g)(1)(iii)(*c*), (g)(1)(v), (g)(3)(iv)(*a*), (g)(3)(iv)(*b*),

(g)(3)(iv)(*c*), (g)(3)(v)(*a*), (g)(3)(vi)(*a*), Table H–19, and paragraphs (g)(4)(iii)(*d*), (g)(5)(i), (g)(6)(iv), and (g)(7); and

■ L. Revise paragraphs (h)(3)(i)(*a*), (h)(3)(iii)(*b*), (h)(3)(iv), (h)(5), (h)(7)(i)(*b*), (h)(7)(iii)(*c*), and (j).

The revisions read as follows:

§ 1910.106 Flammable liquids.

* * * * *

(a) * * *

(13) Flammable aerosol shall mean a flammable aerosol as defined by Appendix B to § 1910.1200—Physical Hazard Criteria. For the purposes of paragraph (d) of this section, such aerosols are considered Category 1 flammable liquids.

(14) * * *

(i) For a liquid which has a viscosity of less than 45 SUS at 100 °F (37.8 °C), does not contain suspended solids, and does not have a tendency to form a surface film while under test, the procedure specified in the Standard Method of Test for Flashpoint by Tag Closed Tester (ASTM D–56–70), which is incorporated by reference as specified in § 1910.6, or an equivalent test method as defined in Appendix B to § 1910.1200—Physical Hazard Criteria, shall be used.

(ii) For a liquid which has a viscosity of 45 SUS or more at 100 °F (37.8 °C), or contains suspended solids, or has a tendency to form a surface film while under test, the Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester (ASTM D–93–71) or an equivalent method as defined by Appendix B to § 1910.1200—Physical Hazard Criteria, shall be used except that the methods specified in Note 1 to section 1.1 of ASTM D–93–71 may be used for the respective materials specified in the Note. The preceding ASTM standard is incorporated by reference as specified in § 1910.6.

(iii) For a liquid that is a mixture of compounds that have different volatilities and flashpoints, its flashpoint shall be determined by using the procedure specified in paragraph (a)(14)(i) or (ii) of this section on the liquid in the form it is shipped.

* * * * *

(18) [Reserved]

(19) *Flammable liquid* means any liquid having a flashpoint at or below 199.4 °F (93 °C). Flammable liquids are divided into four categories as follows:

(i) Category 1 shall include liquids having flashpoints below 73.4 °F (23 °C) and having a boiling point at or below 95 °F (35 °C).

(ii) Category 2 shall include liquids having flashpoints below 73.4 °F (23 °C) and having a boiling point above 95 °F (35 °C).

(iii) Category 3 shall include liquids having flashpoints at or above 73.4 °F (23 °C) and at or below 140 °F (60 °C). When a Category 3 liquid with a flashpoint at or above 100 °F (37.8 °C) is heated for use to within 30 °F (16.7 °C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint below 100 °F (37.8 °C).

(iv) Category 4 shall include liquids having flashpoints above 140 °F (60 °C) and at or below 199.4 °F (93 °C). When a Category 4 flammable liquid is heated for use to within 30 °F (16.7 °C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint at or above 100 °F (37.8 °C).

(v) When liquid with a flashpoint greater than 199.4 °F (93 °C) is heated for use to within 30 °F (16.7 °C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 4 flammable liquid.

* * * * *

(b) * * *

(2) * * *

(iv) * * *

(*f*)(*1*) Tanks and pressure vessels storing Category 1 flammable liquids shall be equipped with venting devices which shall be normally closed except when venting to pressure or vacuum conditions. Tanks and pressure vessels storing Category 2 flammable liquids and Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C) shall be equipped with venting devices which shall be normally closed except when venting under pressure or vacuum conditions, or with approved flame arresters.

(*2*) Exemption: Tanks of 3,000 bbls (barrels). capacity or less containing crude petroleum in crude-producing areas and outside aboveground atmospheric tanks under 1,000 gallons capacity containing other than Category 1 flammable liquids may have open vents. (*See* paragraph (b)(2)(vi)(*b*) of this section.)

(*g*) Flame arresters or venting devices required in paragraph (b)(2)(iv)(*f*) of this section may be omitted for Category 2 flammable liquids and Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C) where conditions are such that their use may, in case of obstruction, result in tank damage.

* * * * *

(vi) * * *

(*b*) Where vent pipe outlets for tanks storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 feet above the adjacent ground level. In order to aid their dispersion, vapors shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least five feet from building openings.

* * * * *

(viii) * * *

(*e*) For Category 2 flammable liquids and Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within 6 inches of the bottom of the tank and shall be installed to avoid excessive vibration.

* * * * *

(3) * * *

(i) *Location.* Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), to the nearest wall of any basement or pit shall be not less than 1 foot, and to any property line that may be built upon, not less than 3 feet. The distance from any part of a tank storing Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids to the nearest wall of any basement, pit or property line shall be not less than 1 foot.

* * * * *

(iv) * * *

(*a*) Location and arrangement of vents for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C). Vent pipes from tanks storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet above the adjacent ground level. Vent pipes shall discharge only upward in order to disperse vapors. Vent pipes 2 inches or less in nominal inside

diameter shall not be obstructed by devices that will cause excessive back pressure. Vent pipe outlets shall be so located that flammable vapors will not enter building openings, or be trapped under eaves or other obstructions. If the vent pipe is less than 10 feet in length, or greater than 2 inches in nominal inside diameter, the outlet shall be provided with a vacuum and pressure relief device or there shall be an approved flame arrester located in the vent line at the outlet or within the approved distance from the outlet.

* * * * *

(*c*) Location and arrangement of vents for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids. Vent pipes from tanks storing Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids shall terminate outside of the building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, coarse screens or other devices to minimize ingress of foreign material.

* * * * *

(v) * * *

(*d*) For Category 2 flammable liquids and Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 inches of the bottom of the tank.

* * * * *

(4) * * *

(iv) * * *

(*e*) For Category 2 flammable liquids and Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasoline, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 inches of the bottom of the tank.

* * * * *

(d) * * *

(1) * * *

(ii) * * *

(*b*) Category 1, 2, or 3 flammable liquids in the fuel tanks of a motor vehicle, aircraft, boat, or portable or stationary engine;

* * * * *

(2) * * *

(iii) *Size.* Flammable liquid containers shall be in accordance with Table H–12, except that glass or plastic containers of no more than 1-gallon capacity may be used for a Category 1 or 2 flammable liquid if:

(*a*) * * *

(*2*) The user's process either would require more than 1 pint of a Category 1 flammable liquid or more than 1 quart of a Category 2 flammable liquid of a single assay lot to be used at one time, or would require the maintenance of an analytical standard liquid of a quality which is not met by the specified standards of liquids available, and the quantity of the analytical standard liquid required to be used in any one control process exceeds one-sixteenth the capacity of the container allowed under Table H–12 for the category of liquid; or

* * * * *

TABLE H–12—MAXIMUM ALLOWABLE SIZE OF CONTAINERS AND PORTABLE TANKS FOR FLAMMABLE LIQUIDS

Container type	Category 1	Category 2	Category 3	Category 4
Glass or approved plastic	1 pt	1 qt	1 gal	1 gal.
Metal (other than DOT drums)	1 gal	5 gal	5 gal	5 gal.
Safety cans	2 gal	5 gal	5 gal	5 gal.
Metal drums (DOT specifications)	60 gal	60 gal	60 gal	60 gal.
Approved portable tanks	660 gal	660 gal	660 gal	660 gal.

Note: Container exemptions: (a) Medicines, beverages, foodstuffs, cosmetics, and other common consumer items, when packaged according to commonly accepted practices, shall be exempt from the requirements of 1910.106(d)(2)(i) and (ii).

(3) * * *

(i) *Maximum capacity.* Not more than 60 gallons of Category 1, 2, or 3 flammable liquids, nor more than 120 gallons of Category 4 flammable liquids may be stored in a storage cabinet.

* * * * *

(4) * * *

(iii) *Wiring.* Electrical wiring and equipment located in inside storage rooms used for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be approved under subpart S of this part for Class I, Division 2 Hazardous Locations; for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids, shall be approved for general use.

(iv) *Ventilation.* Every inside storage room shall be provided with either a gravity or a mechanical exhaust ventilation system. Such system shall be designed to provide for a complete change of air within the room at least six times per hour. If a mechanical exhaust system is used, it shall be controlled by a switch located outside of the door. The ventilating equipment and any lighting fixtures shall be operated by the same switch. A pilot light shall be installed adjacent to the switch if Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are dispensed within the room. Where gravity ventilation is provided, the fresh air intake, as well as the exhaust outlet from the room, shall be on the exterior of the building in which the room is located.

* * * * *

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TABLE H-14 - INDOOR CONTAINER STORAGE

Category liquid	Storage level	Gallons	
		Protected storage maximum per pile	Unprotected storage maximum per pile
1	Ground and upper floors.....	2,750 (50)	660 (12)
	Basement.....	Not permitted	Not permitted
2	Ground and upper floors.....	5,500 (100)	1,375 (25)
	Basement.....	Not permitted	Not permitted
3 ..... FP<100F	Ground and upper floors.....	16,500 (300)	4,125 (75)
	Basement.....	Not permitted	Not permitted
3 .... FP≥100F	Ground and upper floors.....	16,500 (300)	4,125 (75)
	Basement.....	5,500 (100)	Not permitted
4 ...	Ground and upper floors.....	55,000 (1,000)	13,750 (250)
	Basement.....	8,250 (450)	Not permitted

NOTE 1: When 2 or more categories of materials are stored in a single pile, the maximum gallonage permitted in that pile shall be the smallest of the 2 or more separate maximum gallonages.

NOTE 2: Aisles shall be provided so that no container is more than 12 ft. from an aisle. Main aisles shall be at least 3 ft. wide and side aisles at least 4 ft. wide.

NOTE 3: Each pile shall be separated from each other by at least 4 ft.

NOTE 4: FP means Flashpoint.

(Number in parenthesis indicate corresponding number of 55-gal. drums.)

TABLE H-15 - INDOOR PORTABLE TANK STORAGE

Category	Storage level	Gallons	
		Protected storage maximum per pile	Unprotected storage maximum per pile
1	Ground and upper floors	Not permitted	Not permitted
	Basement	Not permitted	Not permitted
2	Ground and upper floors	20,000	2,000
	Basement	Not permitted	Not permitted
3 FP<100F	Ground and upper floors	40,000	5,500
	Basement	Not permitted	Not permitted
3 FP≥100F	Ground and upper floors	40,000	5,500
	Basement	20,000	Not permitted
4	Ground and upper floors	60,000	22,000
	Basement	20,000	Not permitted

NOTE 1: When 1 or more categories of materials are stored in a single pile, the maximum gallonage permitted in that pile shall be the smallest of the 2 or more separate maximum gallonages.

NOTE 2: Aisles shall be provided so that no portable tank is more than 12 ft. from an aisle. Main aisles shall be at least 8 ft. wide and side aisles at least 4 ft. wide.

NOTE 3: Each pile shall be separated from each other by at least 4 ft.

NOTE 4: FP means Flashpoint.

TABLE H-16 - OUTDOOR CONTAINER STORAGE

1-Category	2-Maximum per pile	3-Distance between piles	4-Distance to property line that can be built upon	5-Distance to street, alley, public way
	gallons	feet	feet	feet
1	1,100	5	20	10
2	2,200	5	20	10
3 FP<100F.	4,400	5	20	10
3 FP≥100F.	8,800	5	10	5
4	22,000	5	10	5

NOTE 1: When 2 or more categories of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the 2 or more separate gallonages.

NOTE 2: Within 200 ft. of each container, there shall be a 12 ft. wide access way to permit approach of fire control apparatus.

NOTE 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

NOTE 4: When total quantity stored does not exceed 50 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but not less than 3 ft.

NOTE 5: FP means flashpoint.

TABLE H-17 - OUTDOOR PORTABLE TANK STORAGE

1-Category	2-Maximum per pile	3-Distance between piles	4-Distance to property line that can be built upon	5-Distance to street, alley, public way
	gallons	feet	feet	feet
1	2,200	5	20	10
2	4,400	5	20	10
3 FP<100F.	8,800	5	20	10
3 FP≥100F.	17,600	5	10	5
4	44,000	5	10	5

NOTE 1: When 2 or more categories of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the 2 or more separate gallonages.

NOTE 2: Within 200 ft. of each portable tank, there shall be a 12 ft. wide access way to permit approach of fire control apparatus.

NOTE 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

NOTE 4: When total quantity stored does not exceed 50 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but not less than 3 ft.

NOTE 5: FP means flashpoint.

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(7) * * *

(i) * * *

(*b*) At least one portable fire extinguisher having a rating of not less than 12–B units must be located not less than 10 feet, nor more than 25 feet, from any Category 1, 2, or 3 flammable liquid storage area located outside of a storage room but inside a building.

* * * * *

(e) * * *

(2) * * *

(ii) * * *

(*b*) * * *

(*1*) 25 gallons of Category 1 flammable liquids in containers

(*2*) 120 gallons of Category 2, 3, or 4 flammable liquids in containers

(*3*) 660 gallons of Category 2, 3, or 4 flammable liquids in a single portable tank.

* * * * *

(iv) * * *

(*a*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be kept in covered containers when not actually in use.

* * * * *

(*c*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), may be used only where there are no open flames or other sources of ignition within the possible path of vapor travel.

* * * * *

(3) * * *

(v) * * *

(*a*) Areas as defined in paragraph (e)(3)(i) of this section using Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building. Provision shall be made for introduction of makeup air in such a manner as not to short circuit the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect.

(*b*) Equipment used in a building and the ventilation of the building shall be designed so as to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 feet from equipment which exposes Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.

* * * * *

(4) * * *

(i) Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property which may be built upon by a distance of 25 feet for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), and 15 feet for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids, measured from the nearest

position of any fill stem. Buildings for pumps or shelters for personnel may be a part of the facility. Operations of the facility shall comply with the appropriate portions of paragraph (f)(3) of this section.

* * * * *

(6) * * *

(ii) *Grounding.* Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

(7) * * *

(i) * * *

(*c*) Locations where flammable vapor-air mixtures may exist under abnormal conditions and for a distance beyond Division 1 locations shall be classified Division 2 according to the requirements of subpart S of this part. These locations include an area within 20 feet horizontally, 3 feet vertically beyond a Division 1 area, and up to 3 feet above floor or grade level within 25 feet, if indoors, or 10 feet if outdoors, from any pump, bleeder, withdrawal fitting, meter, or similar device handling Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C). Pits provided with adequate mechanical ventilation within a Division 1 or 2 area shall be classified Division 2. If only Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids are handled, then ordinary electrical equipment is satisfactory though care shall be used in locating electrical apparatus to prevent hot metal from falling into open equipment.

* * * * *

(f) * * *

(1) * * *

(i) *Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C).* Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be stored in closed containers, or in storage tanks above ground outside of buildings, or underground in accordance with paragraph (b) of this section.

(ii) *Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids.* Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids shall be stored in containers, or in tanks within buildings or above ground outside of buildings, or underground in accordance with paragraph (b) of this section.

* * * * *

(2) * * *

(ii) *Heating.* Rooms in which Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are stored or handled shall be heated only by means not constituting a source of ignition, such as steam or hot water. Rooms containing heating appliances involving sources of ignition shall be located and arranged to prevent entry of flammable vapors.

(iii) * * *

(*a*) Ventilation shall be provided for all rooms, buildings, or enclosures in which Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are pumped or dispensed. Design of ventilation systems shall take into account the relatively high specific gravity of the vapors. Ventilation may be provided by adequate openings in outside walls at floor level unobstructed except by louvers or coarse screens. Where natural ventilation is inadequate, mechanical ventilation shall be provided.

(*b*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

(*c*) Containers of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be drawn from or filled within buildings unless provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, it shall be kept in operation while flammable liquids with a flashpoint below 100 °F (37.8 °C) are being handled.

(3) * * *

(i) *Separation.* Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property that may be built upon by a distance of 25 feet for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), and 15 feet for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids measured from the nearest position of any fill spout. Buildings for pumps or shelters for personnel may be a part of the facility.

(ii) *Category restriction.* Equipment such as piping, pumps, and meters used for the transfer of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), between storage tanks and the fill stem of the loading rack shall not be used for the transfer of Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids.

* * * * *

(iv) * * *

(*a*) * * *

(*1*) Where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are loaded, or

(*2*) Where Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids are loaded into vehicles which may contain vapors from previous cargoes of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C).

* * * * *

(*d*) * * *

(*2*) Where no Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are handled at the loading facility and the tank vehicles loaded are used exclusively for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids; and

* * * * *

(v) *Stray currents.* Tank car loading facilities where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are loaded through open domes shall be protected against stray currents by bonding the pipe to at least one rail and to the rack structure if of metal. Multiple lines entering the rack area shall be electrically bonded together. In addition, in areas where excessive stray currents are known to exist, all pipe entering the rack area shall be provided with insulating sections to electrically isolate the rack piping from the pipelines. No bonding between the tank car and the rack or piping is required during either loading or unloading of Category 3 flammable liquids with a

flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids.

(vi) *Container filling facilities.* Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

(4) * * *

(viii) * * *

(*e*) In addition to the requirements of paragraph (f)(4)(viii)(*d*) of this section, each line conveying Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), leading to a wharf shall be provided with a readily accessible block valve located on shore near the approach to the wharf and outside of any diked area. Where more than one line is involved, the valves shall be grouped in one location.

* * * * *

(5) * * *

(i) *Application.* This paragraph (f)(5)(i) shall apply to areas where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are stored or handled. For areas where only Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids are stored or handled, the electrical equipment may be installed in accordance with the provisions of Subpart S of this part, for ordinary locations.

* * * * *

(6) *Sources of ignition.* Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be handled, drawn, or dispensed where flammable vapors may reach a source of ignition. Smoking shall be prohibited except in designated localities. "No Smoking" signs shall be conspicuously posted where hazard from flammable liquid vapors is normally present.

* * * * *

(8) *Fire control.* Suitable fire-control devices, such as small hose or portable fire extinguishers, shall be available to locations where fires are likely to occur. Additional fire-control equipment may be required where a tank of more than 50,000 gallons individual capacity contains Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), and where an unusual exposure hazard exists from surrounding property. Such additional fire-control equipment shall be sufficient to extinguish a fire in the largest tank. The design and amount of such equipment shall be in accordance with approved engineering standards.

* * * * *

(g) * * *

(1) * * *

(i) * * *

(*c*) Apparatus dispensing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), into the fuel tanks of motor vehicles of the public shall not be located at a bulk plant unless separated by a fence or similar barrier from the area in which bulk operations are conducted.

* * * * *

(*e*) The provisions of paragraph (g)(1)(i)(*a*) of this section shall not prohibit the dispensing of flammable liquids with a flashpoint below 100 °F (37.8 °C) in the open from a tank vehicle to a motor vehicle. Such dispensing shall be permitted provided:

* * * * *

(*f*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

* * * * *

(iii) * * *

(*a*) Except where stored in tanks as provided in paragraph (g)(1)(ii) of this section, no Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be stored within any service station building except in closed containers of aggregate capacity not exceeding 60 gallons. One container not exceeding 60 gallons capacity equipped with an approved pump is permitted.

(*b*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), may be transferred from one container to another in lubrication or service rooms of a service station building provided the electrical installation complies with Table H–19 and provided that any heating equipment complies with paragraph (g)(6) of this section.

(*c*) Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids may be stored and dispensed inside service station buildings from tanks of not more than 120 gallons capacity each.

* * * * *

(v) *Dispensing into portable containers.* No delivery of any Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be made into portable containers unless the container is constructed of metal, has a tight closure with screwed or spring cover, and is fitted with a spout or so designed so the contents can be poured without spilling.

* * * * *

(3) * * *

(iv) * * *

(*a*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be transferred from tanks by means of fixed pumps so designed and equipped as to allow control of the flow and to prevent leakage or accidental discharge.

(*b*)(*1*) Only listed devices may be used for dispensing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C). No such device may be used if it shows evidence of having been dismantled.

(*2*) Every dispensing device for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), installed after December 31, 1978, shall contain evidence of listing so placed that any attempt to dismantle the device will result in damage to such evidence, visible without disassembly or dismounting of the nozzle.

(*c*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used.

* * * * *

(v) * * *

(*a*) This paragraph (g)(3)(v) shall apply to systems for dispensing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), where such liquids are transferred from storage to individual or multiple dispensing units by pumps located elsewhere than at the dispensing units.

* * * * *

(vi) * * *

(*a*) A listed manual or automatic-closing type hose nozzle valve shall be provided on dispensers used for the dispensing of Category 1 or 2 flammable

liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C).

(4) * * *

(iii) * * *

* * * * *

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TABLE H-19 - ELECTRICAL EQUIPMENT HAZARDOUS AREAS - SERVICE STATIONS

Location	Class I Group D division	Extent of classified area
Underground tank:		
Fill opening.....	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose fill connection and within a horizontal radius of 5 feet from a tight fill connection.
Vent-Discharging Upward.	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
Dispenser:		
Pits	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
Dispenser enclosure ..	1	The area 4 feet vertically above base within the enclosure and 18 inches horizontally in all directions.
Outdoor	2	Up to 18 inches above grade level within 20 feet horizontally of any edge of enclosure.
Indoor:		
With mechanical ventilation	2	Up to 18 inches above grade or floor level within 20 feet horizontally of any edge of enclosure.
With gravity ventilation	2	Up to 18 inches above grade or floor level within 25 feet horizontally of any edge of enclosure.

Remote pump - Outdoor.	1	Any pit, box or space below grade level if any part is within a horizontal distance of 10 feet from any edge of the pump.
	2	Within 3 feet of any edge of the pump, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of the pump.
Remote pump - Indoor..	1	Entire area within any pit.
	2	Within 5 feet of any edge of pump, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of pump.
Lubrication or service room	1	Entire area within any pit.
	2	Area up to 18 inches above floor or grade level within entire lubrication room.
Dispenser for Liquids with a flashpoint below 100 °F (37.8 °C) (1).....	2	Within 3 feet of any fill or dispensing point, extending in all directions.
Special enclosure inside building per 1910.106(f)(1)(ii).	1	Entire enclosure.
Sales, storage and rest rooms.....	(2)	If there is any opening to these rooms within the extent of a Division 1 area, the entire room shall be classified as Division 1.

Footnote (1) Category 1 or 2 flammable liquids, or for Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C).
Footnote (2) Ordinary

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(*d*) Piping handling Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be grounded to control stray currents.

(5) * * *

(i) *Application.* This paragraph (g)(5) shall apply to areas where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are stored or handled. For areas where Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids are stored or handled the electrical equipment may be installed in accordance with the provisions of subpart S of this part, for ordinary locations.

* * * * *

(6) * * *

(iv) *Work areas.* Heating equipment using gas or oil fuel may be installed in the lubrication, sales, or service room where there is no dispensing or transferring of Category 1 or 2 flammable liquids or 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), provided the bottom of the combustion chamber is at least 18 inches above the floor and the heating equipment is protected from physical damage by vehicles. Heating equipment using gas or oil fuel listed for use in garages may be installed in the lubrication or service room where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are dispensed provided the equipment is installed at least 8 feet above the floor.

* * * * *

(7) *Drainage and waste disposal.* Provision shall be made in the area where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are dispensed to prevent spilled liquids from flowing into the interior of service station buildings. Such provision may be by grading driveways, raising door sills, or other equally effective means. Crankcase drainings and flammable liquids shall not be dumped into sewers but shall be stored in tanks or drums

outside of any building until removed from the premises.

* * * * *

(h) * * *

(3) * * *

(i) * * *

(*a*) Processing buildings shall be of fire-resistance or noncombustible construction, except heavy timber construction with load-bearing walls may be permitted for plants utilizing only stable Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids. Except as provided in paragraph (h)(2)(ii) of this section or in the case of explosion resistant walls used in conjunction with explosion relieving facilities, see paragraph (h)(3)(iv) of this section, load-bearing walls are prohibited. Buildings shall be without basements or covered pits.

* * * * *

(iii) * * *

(*b*) Equipment used in a building and the ventilation of the building shall be designed so as to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment, and to not more than 5 feet from equipment which exposes Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.

(iv) *Explosion relief.* Areas where Category 1 or unstable liquids are processed shall have explosion venting through one or more of the following methods:

* * * * *

(5) *Tank vehicle and tank car loading and unloading.* Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings, or nearest line of adjoining property which may be built upon by a distance of 25 feet for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), and 15 feet for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) and Category 4 flammable liquids measured from the nearest position of any fill stem. Buildings for pumps or shelters for personnel may be a part of the facility. Operations of the facility shall comply with the appropriate portions of paragraph (f)(3) of this section.

* * * * *

(7) * * *

(i) * * *

(*b*) Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

* * * * *

(iii) * * *

(*c*) Locations where flammable vapor-air mixtures may exist under abnormal conditions and for a distance beyond Division 1 locations shall be classified Division 2 according to the requirements of subpart S of this part. These locations include an area within 20 feet horizontally, 3 feet vertically beyond a Division 1 area, and up to 3 feet above floor or grade level within 25 feet, if indoors, or 10 feet if outdoors, from any pump, bleeder, withdrawal fitting, meter, or similar device handling Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C). Pits provided with adequate mechanical ventilation within a Division 1 or 2 area shall be classified Division 2. If Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids only are handled, then ordinary electrical equipment is satisfactory though care shall be used in locating electrical apparatus to prevent hot metal from falling into open equipment.

* * * * *

(j) *Scope.* This section applies to the handling, storage, and use of flammable liquids with a flashpoint at or below 199.4 °F (93 °C) unless otherwise noted. This section does not apply to:

* * * * *

■ 5. Amend § 1910.107 as follows:

■ A. Amend paragraphs (c)(9)(i), (e)(1), (e)(2), (e)(3), (e)(6)(iv), (e)(8), and (e)(9) by removing the terms "flammable or combustible liquids" wherever it appears and adding in its place the phrase "flammable liquids or liquids with a flashpoint greater than 199.4 °F (93 °C)"; and

■ B. Revise the heading of paragraph (e), and (e)(4) to read as follows:

§ 1910.107 Spray finishing using flammable and combustible materials.

* * * * *

(e) *Flammable liquids and liquids with a flashpoint greater than 199.4 °F (93 °C)*

* * * * *

(4) *Transferring liquids.* Except as provided in paragraph (e)(5) of this section the withdrawal of flammable liquids and liquids with a flashpoint greater than 199.4 °F (93 °C) from containers having a capacity of greater than 60 gallons shall be by approved pumps. The withdrawal of flammable liquids or liquids with a flashpoint greater than 199.4 °F (93 °C) from containers and the filling of containers, including portable mixing tanks, shall be done only in a suitable mixing room or in a spraying area when the ventilating system is in operation. Adequate precautions shall be taken to protect against liquid spillage and sources of ignition.

* * * * *

■ 6. Amend § 1910.119 to revise paragraphs (a)(1)(ii) introductory text, (a)(1)(ii)(B) and the definition of "Trade secret" in paragraph (b) to read as follows:

§ 1910.119 Process safety management of highly hazardous chemicals.

* * * * *

(a) * * *

(1) * * *

(ii) A process which involves a Category 1 flammable gas (as defined in 1910.1200(c)) or a flammable liquid with a flashpoint below 100 °F (37.8 °C) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:

* * * * *

(B) Flammable liquids with a flashpoint below 100 °F (37.8 °C) stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

* * * * *

(b) * * *

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. *See* Appendix E to § 1910.1200—Definition of a Trade Secret (which sets out the criteria to be used in evaluating trade secrets).

* * * * *

■ 7. In § 1910.120, revise the definition of the term *Health hazard* in paragraph (a)(3) to read as follows:

§ 1910.120 Hazardous waste operations and emergency response.

(a) * * *

(3) * * *

Health hazard means a chemical or a pathogen where acute or chronic health

effects may occur in exposed employees. It also includes stress due to temperature extremes. The term *health hazard* includes chemicals that are classified in accordance with the Hazard Communication Standard, 29 CFR 1910.1200, 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); aspiration toxicity or simple asphyxiant. (*See* Appendix A to § 1910.1200—Health Hazard Criteria (Mandatory) for the criteria for determining whether a chemical is classified as a health hazard.)

* * * * *

■ 8. Amend paragraph (d) of § 1910.123 by removing the definition of "Combustible liquid" and revising the definitions of the terms "Flammable liquid" and "Flashpoint" to read as follows:

§ 1910.123 Dipping and coating operations: Coverage and definitions.

* * * * *

(d) * * *

Flammable liquid means any liquid having a flashpoint at or below 199.4 °F (93 °C).

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite if tested in accordance with the test methods in Appendix B to § 1910.1200—Physical Hazard Criteria.

* * * * *

■ 9. In § 1910.124, revise paragraph (c)(2) introductory text to read as follows:

§ 1910.124 General requirements for dipping and coating operations.

* * * * *

(c) * * *

(2) You must ensure that any exhaust air re-circulated from a dipping or coating operation using flammable liquids or liquids with flashpoints greater than 199.4 °F (93 °C) is:

* * * * *

■ 10. Amend § 1910.125 by revising the section heading and the introductory text (including the table) to read as follows:

§ 1910.125 Additional requirements for dipping and coating operations that use flammable liquids or liquids with flashpoints greater than 199.4 °F (93 °C).

If you use flammable liquids, you must comply with the requirements of this section as well as the requirements of §§ 1910.123, 1910.124, and 1910.126, as applicable.

You must also comply with this section if:	And:
• The flashpoint of the liquid is 199.4 °F (93 °C) or above	• The liquid is heated as part of the operation; or • A heated object is placed in the liquid.

■ 11. Amend the introductory text of paragraph (c) of § 1910.126 by removing the words "or combustible".

Subpart Q—[Amended]

■ 12. The authority citation for subpart Q continues to read as follows:

Authority: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Secretary of Labor's Orders Nos. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355), or 1–2012 (77 FR 3912), as applicable; and 29 CFR part 1911.

■ 13. Amend § 1910.252 as follows;

■ A. Revise paragraph (c)(1)(iv);

■ B. Add new paragraphs (c)(1)(v) and (c)(1)(vi).

§ 1910.252 General requirements.

* * * * *

(c) * * *

(1) * * *

(iv) *Hazard communication.* The employer shall include the potentially hazardous materials employed in fluxes, coatings, coverings, and filler metals, all of which are potentially used in welding and cutting, or are released to the atmosphere during welding and cutting, in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of such materials and safety data sheets, and is trained in accordance with the provisions of § 1910.1200. Potentially hazardous materials shall include but not be limited to the materials itemized in paragraphs (c)(5) through (c)(12) of this section.

(v) *Additional considerations for hazard communication in welding, cutting, and brazing.* (A) The suppliers shall determine and shall label in accordance with § 1910.1200 any hazards associated with the use of their materials in welding, cutting, and brazing.

(B) In addition to any requirements imposed by § 1910.1200, all filler metals and fusible granular materials shall carry the following notice, as a minimum, on tags, boxes, or other containers:

Do not use in areas without adequate ventilation. *See* ANSI Z49.1–1967 Safety in Welding, Cutting, and Allied Processes published by the American Welding Society.

(C) Where brazing (welding) filler metals contain cadmium in significant amounts, the labels shall indicate the hazards associated with cadmium including cancer, lung and kidney effects, and acute toxicity effects.

(D) Where brazing and gas welding fluxes contain fluorine compounds, the labels shall indicate the hazards associated with fluorine compounds including eye and respiratory tract effects.

(vi) Prior to June 1, 2015, employers may include the following information on labels in lieu of the labeling requirements in paragraph (c)(1)(v) of this section:

(A) All filler metals and fusible granular materials shall carry the following notice, as a minimum, on tags, boxes, or other containers:

CAUTION

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. *See* ANSI Z49.1–1967 Safety in Welding and Cutting published by the American Welding Society.

(B) Brazing (welding) filler metals containing cadmium in significant amounts shall carry the following notice on tags, boxes, or other containers:

WARNING
CONTAINS CADMIUM—POISONOUS FUMES MAY BE FORMED ON HEATING

Do not breathe fumes. Use only with adequate ventilation such as fume collectors, exhaust ventilators, or air-supplied respirators. *See* ANSI Z49.1–1967. If chest pain, cough, or fever develops after use call physician immediately.

(C) Brazing and gas welding fluxes containing fluorine compounds shall have a cautionary wording to indicate that they contain fluorine compounds. One such cautionary wording recommended by the American Welding

Society for brazing and gas welding fluxes reads as follows:

CAUTION
CONTAINS FLUORIDES

This flux when heated gives off fumes that may irritate eyes, nose and throat.

1. Avoid fumes—use only in well-ventilated spaces.
2. Avoid contact of flux with eyes or skin.
3. Do not take internally.

* * * * *

Subpart Z—[Amended]

■ 14. Revise the authority citation for subpart Z to read as follows:

Authority: Sections 4, 6, 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355), or 1–2012 (77 FR 3912), as applicable; and 29 CFR part 1911.

All of subpart Z issued under section 6(b) of the Occupational Safety and Health Act of 1970, except those substances that have exposure limits listed in Tables Z–1, Z–2, and Z–3 of 29 CFR 1910.1000. The latter were issued under section 6(a) (29 U.S.C. 655(a)).

Section 1910.1000, Tables Z–1, Z–2 and Z–3 also issued under 5 U.S.C. 553, but not under 29 CFR part 1911 except for the arsenic (organic compounds), benzene, cotton dust, and chromium (VI) listings.

Section 1910.1001 also issued under section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704) and 5 U.S.C. 553.

Section 1910.1002 also issued under 5 U.S.C. 553, but not under 29 U.S.C. 655 or 29 CFR part 1911.

Sections 1910.1018, 1910.1029, and 1910.1200 also issued under 29 U.S.C. 653.

Section 1910.1030 also issued under Pub. L. 106–430, 114 Stat. 1901.

Section 1910.1201 also issued under 49 U.S.C. 1801–1819 and 5 U.S.C. 533.

■ 15. Amend § 1910.1001 as follows:

■ A. Remove paragraph (j)(5);

■ B. Redesignate paragraphs (j)(1) through (j)(4) as paragraphs (j)(2) through (j)(5);

■ C. Revise paragraphs (h)(2)(iv), (h)(3)(vi), the newly redesignated paragraphs (j)(4), (j)(5), and the introductory text of paragraph (j)(6);

■ D. Add new paragraph (j)(1);

■ E. Amend Appendix F, to § 1910.1001, Paragraph [A] (6) by removing "(j)(4)" and adding in its place "(j)(5)".

The revisions and additions read as follows:

§ 1910.1001 Asbestos.

* * * * *

(h) * * *

(2) * * *

(iv) The employer shall ensure that containers of contaminated protective devices or work clothing, which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal, bear labels in accordance with paragraph (j) of this section.

(3) * * *

(vi) The employer shall ensure that contaminated clothing is transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (j) of this section.

* * * * *

(j) * * *

(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for asbestos.

(ii) In classifying the hazards of asbestos at least the following hazards are to be addressed: Cancer and lung effects.

(iii) Employers shall include asbestos in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of asbestos and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (j)(7) of this section.

* * * * *

(4) *Warning signs*—(i) *Posting.* Warning signs shall be provided and displayed at each regulated area. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(ii) *Sign specifications:*

(A) The warning signs required by paragraph (j)(4)(i) of this section shall bear the following legend:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

(B) In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA

(C) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(4)(ii)(A) of this section:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

(D) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(4)(ii)(B) of this section:

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

(iii) The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by paragraph (j)(4)(i) of this section. Means to ensure employee comprehension may include the use of foreign languages, pictographs and graphics.

(iv) At the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain ACM and/or PACM, the building owner shall post signs which identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that ACM and/or PACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

(5) *Warning labels*—(i) *Labeling.* Labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers. When a building owner or employer identifies previously installed ACM and/or PACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain ACM and/or PACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs required by paragraph (j) of this section may be posted in lieu of labels so long as they contain the information required for labeling.

(ii) *Label specifications.* In addition to the requirements of paragraph (j)(1), the employer shall ensure that labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

(iii) Prior to June 1, 2015, employers may include the following information on raw materials, mixtures or labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers in lieu of the labeling requirements in paragraphs (j)(1)(i) and (j)(5)(ii) of this section:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

(6) The provisions for labels and for safety data sheets required by paragraph (j) of this section do not apply where:

* * * * *

■ 16. Amend § 1910.1003 as follows:
■ A. In the last sentence in paragraph (c)(4)(v) remove the words "paragraphs (e)(2), (3), and (4)" and add the words "paragraph (e)" in their place;
■ B. Revise the heading of paragraph (e);
■ C. Revise paragraphs (e)(1) and (e)(2).
■ D. Remove paragraph (e)(3); and
■ E. Redesignate paragraphs (e)(4) and (e)(5) as (e)(3) and (e)(4).

The revisions read as follows:

§ 1910.1003 13 Carcinogens (4-nitrobiphenyl, etc.).

* * * * *

(e) *Communication of hazards*—(1) *Hazard communication.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for each carcinogen listed in paragraph (e)(1)(iv) of this section.

(ii) In classifying the hazards of carcinogens listed in paragraph (e)(1)(iv) of this section, at least the hazards listed in paragraph (e)(1)(iv) are to be addressed.

(iii) Employers shall include the carcinogens listed in paragraph (e)(1)(iv) of this section in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of the carcinogens listed in paragraph (e)(1)(iv) and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (e)(4) of this section.

(iv) List of Carcinogens:

(A) 4-Nitrobiphenyl: Cancer.

(B) alpha-Naphthylamine: Cancer; skin irritation; and acute toxicity effects.

(C) Methyl chloromethyl ether: Cancer; skin, eye and respiratory effects; acute toxicity effects; and flammability.

(D) 3,3′-Dichlorobenzidine (and its salts): Cancer and skin sensitization.

(E) bis-Chloromethyl ether: Cancer; skin, eye, and respiratory tract effects; acute toxicity effects; and flammability.

(F) beta-Naphthylamine: Cancer and acute toxicity effects.

(G) Benzidine: Cancer and acute toxicity effects.

(H) 4-Aminodiphenyl: Cancer.

(I) Ethyleneimine: Cancer; mutagenicity; skin and eye effects; liver effects; kidney effects; acute toxicity effects; and flammability.

(J) beta-Propiolactone: Cancer; skin irritation; eye effects; and acute toxicity effects.

(K) 2-Acetylaminofluorene: Cancer.

(L) 4-Dimethylaminoazo-benzene: Cancer; skin effects; and respiratory tract irritation.

(M) N-Nitrosodimethylamine: Cancer; liver effects; and acute toxicity effects.

(2) *Signs.* (i) The employer shall post entrances to regulated areas with signs bearing the legend:

DANGER
(CHEMICAL IDENTIFICATION)
MAY CAUSE CANCER
AUTHORIZED PERSONNEL ONLY

(ii) The employer shall post signs at entrances to regulated areas containing operations covered in paragraph (c)(5) of this section. The signs shall bear the legend:

DANGER
(CHEMICAL IDENTIFICATION)
MAY CAUSE CANCER
WEAR AIR-SUPPLIED HOODS, IMPERVIOUS SUITS, AND PROTECTIVE EQUIPMENT IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(iii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (e)(2)(i) of this section:

CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY

(iv) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (e)(2)(ii) of this section:

CANCER-SUSPECT AGENT EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING GLOVES, BOOTS, AND AIR-SUPPLIED HOOD REQUIRED AT ALL TIMES
AUTHORIZED PERSONNEL ONLY

(v) Appropriate signs and instructions shall be posted at the entrance to, and exit from, regulated areas, informing employees of the procedures that must be followed in entering and leaving a regulated area.

* * * * *

■ 17. Revise § 1910.1017 paragraph (l) to read as follows:

§ 1910.1017 Vinyl chloride.

* * * * *

(l) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for vinyl chloride and polyvinyl chloride.

(ii) In classifying the hazards of vinyl chloride at least the following hazards are to be addressed: Cancer; central nervous system effects; liver effects; blood effects; and flammability.

(iii) Employers shall include vinyl chloride in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of vinyl chloride and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (j) of this section.

(2) *Signs.* (i) The employer shall post entrances to regulated areas with legible signs bearing the legend:

DANGER
VINYL CHLORIDE
MAY CAUSE CANCER
AUTHORIZED PERSONNEL ONLY

(ii) The employer shall post signs at areas containing hazardous operations or where emergencies currently exist. The signs shall be legible and bear the legend:

DANGER
VINYL CHLORIDE
MAY CAUSE CANCER
WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(iii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (l)(2)(i) of this section:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

(iv) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (l)(2)(ii) of this section:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

(3) *Labels.* (i) In addition to the other requirements in this paragraph (l), the employer shall ensure that labels for containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride are legible and include the following information:

CONTAMINATED WITH VINYL CHLORIDE
MAY CAUSE CANCER

(ii) Prior to June 1, 2015, employers may include the following information on labels of containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl

chloride in lieu of the labeling requirements in paragraphs (l)(3)(i) of this section:

CONTAMINATED WITH VINYL CHLORIDE
CANCER-SUSPECT AGENT

(4) Prior to June 1, 2015, employers may include the following information for containers of polyvinyl chloride in lieu of the labeling requirements in paragraphs (l)(1)(i) of this section:

POLYVINYL CHLORIDE (OR TRADE NAME)
Contains
VINYL CHLORIDE
VINYL CHLORIDE IS A CANCER-SUSPECT AGENT

(5)(i) Prior to June 1, 2015, employers may include either the following information in either paragraph (l)(5)(i) or (l)(5)(ii) of this section on containers of vinyl chloride in lieu of the labeling requirements in paragraph (l)(1)(i) of this section:

VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS UNDER PRESSURE
CANCER-SUSPECT AGENT

(ii) In accordance with 49 CFR Parts 170–189, with the additional legend applied near the label or placard:

CANCER-SUSPECT AGENT

(6) No statement shall appear on or near any required sign, label, or instruction which contradicts or detracts from the effect of any required warning, information, or instruction.

* * * * *

■ 18. Revise § 1910.1018 paragraphs (j)(2)(vii) and (p) to read as follows:

§ 1910.1018 Inorganic arsenic.

* * * * *

(j) * * *

(2) * * *

(vii) Labels on contaminated protective clothing and equipment.

(A) The employer shall ensure that the containers of contaminated protective clothing and equipment in the workplace or which are to be removed from the workplace are labeled and that the labels include the following information:

DANGER: CONTAMINATED WITH INORGANIC ARSENIC. MAY CAUSE CANCER. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF INORGANIC ARSENIC CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE OR FEDERAL REGULATIONS.

(B) Prior to June 1, 2015, employers may include the following information on containers of protective clothing and equipment in lieu of the labeling requirements in paragraphs (j)(2)(vii) of this section:

CAUTION: Clothing contaminated with inorganic arsenic; do not remove dust by blowing or shaking. Dispose of inorganic arsenic contaminated wash water in accordance with applicable local, State or Federal regulations.

* * * * *

(p) *Communication of hazards*—(1) *Hazard communication—General.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for inorganic arsenic.

(ii) In classifying the hazards of inorganic arsenic at least the following hazards are to be addressed: Cancer; liver effects; skin effects; respiratory irritation; nervous system effects; and acute toxicity effects.

(iii) Employers shall include inorganic arsenic in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of inorganic arsenic and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (o) of this section.

(iv) The employer shall ensure that no statement appears on or near any sign or label required by this paragraph (p) which contradicts or detracts from the meaning of the required sign or label.

(2) *Signs.* (i) The employer shall post signs demarcating regulated areas bearing the legend:

DANGER
INORGANIC ARSENIC
MAY CAUSE CANCER
DO NOT EAT, DRINK OR SMOKE
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(ii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (p)(2)(i) of this section:

DANGER
INORGANIC ARSENIC
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
NO SMOKING OR EATING
RESPIRATOR REQUIRED

(iii) The employer shall ensure that signs required by this paragraph (p) are illuminated and cleaned as necessary so that the legend is readily visible.

(3)(i) Prior to June 1, 2015, in lieu of the labeling requirements in paragraphs (p)(1)(i) of this section, employers may apply precautionary labels to all shipping and storage containers of inorganic arsenic, and to all products containing inorganic arsenic, bearing the following legend:

DANGER
CONTAINS INORGANIC ARSENIC
CANCER HAZARD
HARMFUL IF INHALED OR SWALLOWED
USE ONLY WITH ADEQUATE VENTILATION OR RESPIRATORY PROTECTION

(ii) Labels are not required when the inorganic arsenic in the product is bound in such a manner so as to make unlikely the possibility of airborne exposure to inorganic arsenic. (Possible examples of products not requiring labels are semiconductors, light emitting diodes and glass.)

* * * * *

■ 19. Amend § 1910.1025 as follows:

■ A. Revise paragraph (g)(2)(vii) and paragraph (m);

■ B. Revise Appendix B to § 1910.1025, paragraph xi.

The revisions read as follows:

§ 1910.1025 Lead.

* * * * *

(g) * * *

(2) * * *

(vii) Labeling of contaminated protective clothing and equipment.

(A) The employer shall ensure that labels of bags or containers of contaminated protective clothing and equipment include the following information:

DANGER: CLOTHING AND EQUIPMENT CONTAMINATED WITH LEAD. MAY DAMAGE FERTILITY OR THE UNBORN CHILD. CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM. DO NOT EAT, DRINK OR SMOKE WHEN HANDLING. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

(B) Prior to June 1, 2015, employers may include the following information on bags or containers of contaminated protective clothing and equipment in lieu of the labeling requirements in paragraphs (g)(2)(vii)(A) of this section:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

* * * * *

(m) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for lead.

(ii) In classifying the hazards of lead at least the following hazards are to be addressed: Reproductive/developmental

toxicity; central nervous system effects; kidney effects; blood effects; and acute toxicity effects.

(iii) Employers shall include lead in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of lead and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (l) of this section.

(2) *Signs.* (i) The employer shall post the following warning signs in each work area where the PEL is exceeded:

DANGER
LEAD
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

(ii) The employer shall ensure that no statement appears on or near any sign required by this paragraph (m)(2) which contradicts or detracts from the meaning of the required sign.

(iii) The employer shall ensure that signs required by this paragraph (m)(2) are illuminated and cleaned as necessary so that the legend is readily visible.

(iv) The employer may use signs required by other statutes, regulations, or ordinances in addition to, or in combination with, signs required by this paragraph (m)(2).

(v) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (m)(2)(ii) of this section:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

* * * * *

Appendix B to § 1910.1025—Employee Standard Summary

* * * * *

xi. SIGNS—PARAGRAPH (m)

The standard requires that the following warning sign be posted in the work areas when the exposure to lead exceeds the PEL:

DANGER
LEAD
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

However, prior to June 1, 2016, employers may use the following legend in lieu of that specified above:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

* * * * *

■ 20. Revise § 1910.1026, paragraphs (h)(2)(iv) and (l)(1) to read as follows:

§ 1910.1026 Chromium (VI).

* * * * *

(h) * * *

(2) * * *

(iv) The employer shall ensure that bags or containers of contaminated protective clothing or equipment that are removed from change rooms for laundering, cleaning, maintenance, or disposal are labeled in accordance with the requirements of the Hazard Communication Standard, § 1910.1200.

* * * * *

(l) * * *

(1) *Hazard communication—general* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for chromium (VI).

(ii) In classifying the hazards of chromium (VI) at least the following hazards are to be addressed: Cancer, eye irritation, and skin sensitization.

(iii) Employers shall include chromium (VI) in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of chromium (VI) and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (l)(2) of this section.

* * * * *

■ 21. Revise § 1910.1027 paragraphs (k)(7), (m)(1), (m)(2), and (m)(3) to read as follows:

§ 1910.1027 Cadmium.

* * * * *

(k) * * *

(7) Waste, scrap, debris, bags, containers, personal protective equipment, and clothing contaminated with cadmium and consigned for disposal shall be collected and disposed of in sealed impermeable bags or other closed, impermeable containers. These bags and containers shall be labeled in accordance with paragraph (m) of this section.

* * * * *

(m) * * *

(1) *Hazard communication.—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for cadmium.

(ii) In classifying the hazards of cadmium at least the following hazards are to be addressed: Cancer; lung effects; kidney effects; and acute toxicity effects.

(iii) Employers shall include cadmium in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of cadmium and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (m)(4) of this section.

(2) *Warning signs.* (i) Warning signs shall be provided and displayed in regulated areas. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(ii) Warning signs required by paragraph (m)(2)(i) of this section shall bear the following legend:

DANGER
CADMIUM
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS AND KIDNEYS
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(iii) The employer shall ensure that signs required by this paragraph (m)(2) are illuminated, cleaned, and maintained as necessary so that the legend is readily visible.

(iv) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (m)(2)(ii) of this section:

DANGER
CADMIUM
CANCER HAZARD
CAN CAUSE LUNG AND KIDNEY DISEASE
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN THIS AREA

(3) *Warning labels.* (i) Shipping and storage containers containing cadmium or cadmium compounds shall bear appropriate warning labels, as specified in paragraph (m)(1) of this section.

(ii) The warning labels for containers of contaminated protective clothing, equipment, waste, scrap, or debris shall include at least the following information:

DANGER
CONTAINS CADMIUM
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS AND KIDNEYS
AVOID CREATING DUST

(iii) Prior to June 1, 2015, employers may include the following information on shipping and storage containers containing cadmium, cadmium compounds, or cadmium contaminated clothing, equipment, waste, scrap, or debris in lieu of the labeling

requirements specified in paragraphs (m)(1)(i) and (m)(3)(ii) of this section:

DANGER
CONTAINS CADMIUM
CANCER HAZARD
AVOID CREATING DUST
CAN CAUSE LUNG AND KIDNEY DISEASE

(iv) Where feasible, installed cadmium products shall have a visible label or other indication that cadmium is present.

* * * * *

■ 22. Revise § 1910.1028, paragraph (j) heading, and paragraphs (j)(1) and (j)(2) to read as follows:

§ 1910.1028 Benzene.

* * * * *

(j) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for benzene.

(ii) In classifying the hazards of benzene at least the following hazards are to be addressed: Cancer; central nervous system effects; blood effects; aspiration; skin, eye, and respiratory tract irritation; and flammability.

(iii) Employers shall include benzene in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of benzene and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (j)(3) of this section.

(2) *Warning signs and labels.* (i)The employer shall post signs at entrances to regulated areas. The signs shall bear the following legend:

DANGER
BENZENE
MAY CAUSE CANCER
HIGHLY FLAMMABLE LIQUID AND VAPOR
DO NOT SMOKE
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(ii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(2)(i) of this section:

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE—NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

(iii) The employer shall ensure that labels or other appropriate forms of warning are provided for containers of benzene within the workplace. There is no requirement to label pipes. The labels shall comply with the requirements of paragraph (j)(1) of this section and § 1910.1200(f).

(iv) Prior to June 1, 2015, employers shall include the following legend or similar language on the labels or other appropriate forms of warning:

DANGER
CONTAINS BENZENE
CANCER HAZARD

* * * * *

■ 23. Revise § 1910.1029 paragraph (l) heading, and paragraphs (l)(1) through (l)(3) to read as follows:

§ 1910.1029 Coke oven emissions.

* * * * *

(l) *Communication of hazards*—(1) *Hazard communication—general.* The employer shall include coke oven emissions in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of chemicals and substances associated with coke oven processes and to safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (k) of this section. The employer shall ensure that at least the following hazard is addressed: Cancer.

(2) *Signs.* (i) The employer shall post signs in the regulated area bearing the legend:

DANGER
COKE OVEN EMISSIONS
MAY CAUSE CANCER
DO NOT EAT, DRINK OR SMOKE
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(ii) In addition, the employer shall post signs in the areas where the permissible exposure limit is exceeded bearing the legend:

WEAR RESPIRATORY PROTECTION IN THIS AREA

(iii) The employer shall ensure that no statement appears on or near any sign required by this paragraph (l) which contradicts or detracts from the effects of the required sign.

(iv) The employer shall ensure that signs required by this paragraph (l)(2) are illuminated and cleaned as necessary so that the legend is readily visible.

(v) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (l)(2)(i) of this section:

DANGER
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
NO SMOKING OR EATING

(vi) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (l)(2)(ii) of this section:

DANGER
RESPIRATOR REQUIRED

(3) *Labels.* (i) The employer shall ensure that labels of containers of contaminated protective clothing and equipment include the following information:

CONTAMINATED WITH COKE EMISSIONS
MAY CAUSE CANCER
DO NOT REMOVE DUST BY BLOWING OR SHAKING

(ii) Prior to June 1, 2015, employers may include the following information on contaminated protective clothing and equipment in lieu of the labeling requirements in paragraph (l)(3)(i) of this section:

CAUTION
CLOTHING CONTAMINATED WITH COKE EMISSIONS
DO NOT REMOVE DUST BY BLOWING OR SHAKING

* * * * *

■ 24. Revise § 1910.1043 paragraph (j) to read as follows:

§ 1910.1043 Cotton dust.

* * * * *

(j) *Signs.* (1) The employer shall post the following warning sign in each work area where the permissible exposure limit for cotton dust is exceeded:

DANGER
COTTON DUST
CAUSES DAMAGE TO LUNGS
(BYSSINOSIS)
WEAR RESPIRATORY PROTECTION IN THIS AREA

(2) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(1) of this section:

WARNING
COTTON DUST WORK AREA
MAY CAUSE ACUTE OR DELAYED
LUNG INJURY
(BYSSINOSIS)
RESPIRATORS
REQUIRED IN THIS AREA

* * * * *

■ 25. Revise § 1910.1044 paragraphs (j)(2)(v), (k)(1)(iii)(*b*), and paragraph (o) to read as follows:

§ 1910.1044 1,2-dibromo-3-chloropropane.

* * * * *

(j) * * *

(2) * * *

(v) Containers of DBCP-contaminated protective devices or work clothing which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal shall bear

labels with the following information: CONTAMINATED WITH 1,2–Dibromo-3-chloropropane (DBCP), MAY CAUSE CANCER.

* * * * *

(k) * * *

(1) * * *

(iii) * * *

(*b*) Portable vacuum units used to collect DBCP may not be used for other cleaning purposes and shall be labeled as prescribed by paragraph (j)(2)(v) of this section.

* * * * *

(o) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for DBCP.

(ii) In classifying the hazards of DBCP at least the following hazards are to be addressed: Cancer; reproductive effects; liver effects; kidney effects; central nervous system effects; skin, eye and respiratory tract irritation; and acute toxicity effects.

(iii) Employers shall include DBCP in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of DBCP and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (n) of this section.

(iv) The employer shall ensure that no statement appears on or near any sign or label required by this paragraph (o) which contradicts or detracts from the meaning of the required sign or label.

(2) *Signs.* (i) The employer shall post signs to clearly indicate all regulated areas. These signs shall bear the legend:

DANGER
1,2-Dibromo-3-chloropropane
MAY CAUSE CANCER
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(ii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (o)(2) of this section:

DANGER
1,2-Dibromo-3-chloropropane
(Insert appropriate trade or common names)
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

(3) *Labels.* (i) Where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this paragraph (o)(3) need not be affixed.

(ii) The employer shall ensure that the precautionary labels required by this paragraph (o)(3) are readily visible and legible.

(iii) Prior to June 1, 2015, employers may include the following information on containers of DBCP or products containing DBCP, DBCP-contaminated protective devices or work clothing or DBCP-contaminated portable vacuums in lieu of the labeling requirements in paragraphs (j)(2)(v), (k)(l)(iii)(b) and (o)(1)(i) of this section:

DANGER
1,2-Dibromo-3-chloropropane
CANCER HAZARD

* * * * *

■ 26. Revise § 1910.1045 paragraph (p) to read as follows:

§ 1910.1045 Acrylonitrile.

* * * * *

(p) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for AN and AN-based materials not exempted under paragraph (a)(2) of this section.

(ii) In classifying the hazards of AN and AN-based materials at least the following hazards are to be addressed: Cancer; central nervous system effects; liver effects; skin sensitization; skin, respiratory, and eye irritation; acute toxicity effects; and flammability.

(iii) Employers shall include AN and AN-based materials in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of AN and AN-based materials and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (o) of this section.

(iv) The employer shall ensure that no statement appears on or near any sign or label required by this paragraph (p) that contradicts or detracts from the required sign or label.

(2) *Signs.* (i) The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend:

DANGER
ACRYLONITRILE (AN)
MAY CAUSE CANCER
RESPIRATORY PROTECTION MAY BE REQURED IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(ii) The employer shall ensure that signs required by this paragraph (p)(2) are illuminated and cleaned as necessary so that the legend is readily visible.

(iii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (p)(2)(i) of this section:

DANGER
ACRYLONITRILE (AN)
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS MAY BE REQUIRED

(3) *Labels.* (i) The employer shall ensure that precautionary labels are in compliance with paragraph (p)(1)(i) of this section and are affixed to all containers of liquid AN and AN-based materials not exempted under paragraph (a)(2) of this section. The employer shall ensure that the labels remain affixed when the materials are sold, distributed, or otherwise leave the employer's workplace.

(ii) Prior to June 1, 2015, employers may include the following information on precautionary labels required by this paragraph (p)(3) in lieu of the labeling requirements in paragraph (p)(1) of this section:

DANGER
CONTAINS ACRYLONITRILE (AN)
CANCER HAZARD

(iii) The employer shall ensure that the precautionary labels required by this paragraph (p)(3) are readily visible and legible.

* * * * *

■ 27. Revise § 1910.1047 paragraph (j) heading, and paragraphs (j)(1) and (j)(2) to read as follows:

§ 1910.1047 Ethylene oxide.

* * * * *

(j) *Communication of hazards*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for EtO.

(ii) In classifying the hazards of EtO at least the following hazards are to be addressed: Cancer; reproductive effects; mutagenicity; central nervous system; skin sensitization; skin, eye and respiratory tract irritation; acute toxicity effects; and flammability.

(iii) Employers shall include EtO in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of EtO and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (j)(3) of this section.

(2) *Signs and labels*—(i) *Signs.* (A) The employer shall post and maintain legible signs demarcating regulated areas and entrances or access ways to regulated areas that bear the following legend:

DANGER
ETHYLENE OXIDE
MAY CAUSE CANCER
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING MAY BE REQUIRED IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(B) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (j)(2)(i)(A) of this section:

DANGER
ETHYLENE OXIDE
CANCER HAZARD AND REPRODUCTIVE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING MAY BE REQUIRED TO BE WORN IN THIS AREA

(ii) *Labels.* (A) The employer shall ensure that labels are affixed to all containers of EtO whose contents are capable of causing employee exposure at or above the action level or whose contents may reasonably be foreseen to cause employee exposure above the excursion limit, and that the labels remain affixed when the containers of EtO leave the workplace. For the purposes of this paragraph (j)(2)(ii), reaction vessels, storage tanks, and pipes or piping systems are not considered to be containers.

(B) Prior to June 1, 2015, employers may include the following information on containers of EtO in lieu of the labeling requirements in paragraph (j)(1)(i) of this section:

(*1*) DANGER
CONTAINS ETHYLENE OXIDE
CANCER HAZARD AND REPRODUCTIVE HAZARD;
(*2*) A warning statement against breathing airborne concentrations of EtO.

(C) The labeling requirements under this section do not apply where EtO is used as a pesticide, as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when it is labeled pursuant to that Act and regulations issued under that Act by the Environmental Protection Agency.

* * * * *

■ 28. Revise § 1910.1048 paragraphs (e)(1), (h)(2)(ii), (j)(4) and (m) to read as follows:

§ 1910.1048 Formaldehyde.

* * * * *

(e) * * *

(1) *Signs.* (i) The employer shall establish regulated areas where the concentration of airborne formaldehyde exceeds either the TWA or the STEL and post all entrances and access ways with signs bearing the following legend:

DANGER
FORMALDEHYDE
MAY CAUSE CANCER
CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION
AUTHORIZED PERSONNEL ONLY

(ii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (e)(1)(i) of this section:

DANGER
FORMALDEHYDE
IRRITANT AND POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

* * * * *

(h) * * *

(2) * * *

(ii) When formaldehyde-contaminated clothing and equipment is ventilated, the employer shall establish storage areas so that employee exposure is minimized.

(A) *Signs.* Storage areas for contaminated clothing and equipment shall have signs bearing the following legend:

DANGER
FORMALDEHYDE-CONTAMINATED [CLOTHING] EQUIPMENT
MAY CAUSE CANCER
CAUSES SKIN, EYE AND RESPIRATORY IRRITATION
DO NOT BREATHE VAPOR
DO NOT GET ON SKIN

(B) *Labels.* The employer shall ensure containers for contaminated clothing and equipment are labeled consistent with the Hazard Communication Standard, § 1910.1200, and shall, as a minimum, include the following:

DANGER
FORMALDEHYDE-CONTAMINATED [CLOTHING] EQUIPMENT
MAY CAUSE CANCER
CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION
DO NOT BREATHE VAPOR
DO NOT GET ON SKIN

(C) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (h)(2)(ii)(A) of this section:

DANGER
FORMALDEHYDE-CONTAMINATED [CLOTHING] EQUIPMENT
AVOID INHALATION AND SKIN CONTACT

(D) Prior to June 1, 2015, employers may include the following information on containers of protective clothing and equipment in lieu of the labeling requirements in paragraphs (h)(2)(ii)(B) of this section:

DANGER
FORMALDEHYDE-CONTAMINATED [CLOTHING] EQUIPMENT
AVOID INHALATION AND SKIN CONTACT

* * * * *

(j) * * *

(4) Formaldehyde-contaminated waste and debris resulting from leaks or spills shall be placed for disposal in sealed containers bearing a label warning of formaldehyde's presence and of the hazards associated with formaldehyde. The employer shall ensure that the labels are in accordance with paragraph (m) of this section.

* * * * *

(m) *Communication of hazards.* (1) *Hazard communication—General.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for formaldehyde.

(ii) In classifying the hazards of formaldehyde at least the following hazards are to be addressed: Cancer; skin and respiratory sensitization; eye, skin and respiratory tract irritation; acute toxicity effects; and flammability.

(iii) Employers shall include formaldehyde in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of formaldehyde and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (n) of this section.

(iv) Paragraphs (m)(1)(i), (m)(1)(ii), and (m)(1)(iii) of this section apply to chemicals associated with formaldehyde gas, all mixtures or solutions composed of greater than 0.1 percent formaldehyde, and materials capable of releasing formaldehyde into the air at concentrations reaching or exceeding 0.1 ppm.

(v) In making the determinations of anticipated levels of formaldehyde release, the employer may rely on objective data indicating the extent of potential formaldehyde release under reasonably foreseeable conditions of use.

(2)(i) In addition to the requirements in paragraphs (m)(1) through (m)(1)(iv) of this section, for materials listed in paragraph (m)(1)(iv) capable of releasing formaldehyde at levels above 0.5 ppm, labels shall appropriately address all hazards as defined in paragraph (d) of § 1910.1200 and Appendices A and B to § 1910.1200, including cancer and respiratory sensitization, and shall

contain the hazard statement "May Cause Cancer."

(ii) As a minimum, for all materials listed in paragraph (m)(1)(i) and (iv) of this section capable of releasing formaldehyde at levels of 0.1 ppm to 0.5 ppm, labels shall identify that the product contains formaldehyde; list the name and address of the responsible party; and state that physical and health hazard information is readily available from the employer and from safety data sheets.

(iii) Prior to June 1, 2015, employers may include the phrase "Potential Cancer Hazard" in lieu of "May Cause Cancer" as specified in paragraph (m)(2)(i) of this section.

* * * * *

■ 29. Amend § 1910.1050 as follows:
■ A. Revise the heading of paragraph (k);
■ B. Revise paragraphs (k)(1) and (k)(2);
■ C. Redesignate paragraphs (k)(3) and (k)(4) as (k)(4) and (k)(5);
■ D. Add new paragraph (k)(3).

The revisions and additions read as follows:

§ 1910.1050 Methylenedianiline.

* * * * *

(k) *Communication of hazards*—(1) *Hazard communication—general.*

(i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for MDA.

(ii) In classifying the hazards of MDA at least the following hazards are to be addressed: Cancer; liver effects; and skin sensitization.

(iii) Employers shall include MDA in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of MDA and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (k)(4) of this section.

(2) *Signs and labels*—(i) *Signs.* (A) The employer shall post and maintain legible signs demarcating regulated areas and entrances or access ways to regulated areas that bear the following legend:

DANGER
MDA
MAY CAUSE CANCER
CAUSES DAMAGE TO THE LIVER
RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING MAY BE REQUIRED IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(B) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(2)(i)(A) of this section:

DANGER
MDA
MAY CAUSE CANCER
LIVER TOXIN
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING MAY BE REQUIRED TO BE WORN IN THIS AREA

(ii) *Labels.* Prior to June 1, 2015, employers may include the following information workplace labels in lieu of the labeling requirements in paragraph (k)(1) of this section:

(A) For pure MDA:

DANGER
CONTAINS MDA
MAY CAUSE CANCER
LIVER TOXIN

(B) For mixtures containing MDA:

DANGER
CONTAINS MDA
CONTAINS MATERIALS WHICH MAY CAUSE CANCER
LIVER TOXIN

(3) *Safety data sheets (SDS).* In meeting the obligation to provide safety data sheets, employers shall make appropriate use of the information found in Appendices A and B to § 1910.1050.

* * * * *

■ 30. Revise § 1910.1051 paragraph (l)(1) to read as follows:

§ 1910.1051 1,3-Butadiene.

* * * * *

(l) * * *

(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for BD.

(ii) In classifying the hazards of BD at least the following hazards are to be addressed: Cancer; eye and respiratory tract irritation; center nervous system effects; and flammability.

(iii) Employers shall include BD in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of BD and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (l)(2) of this section.

* * * * *

■ 31. Amend § 1910.1052 as follows:
■ A. Revise paragraph (k);
■ B. Remove the phrase "material safety data sheets (MSDS)" and add in its place the phrase "safety data sheets (SDS)" where it appears in Appendix A, Paragraph X.E.

The revisions read as follows:

§ 1910.1052 Methylene chloride.

* * * * *

(k) *Hazard communication.*—(1) *Hazard communication—general.* (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) (§ 1910.1200) for MC.

(ii) In classifying the hazards of MC at least the following hazards are to be addressed: Cancer, cardiac effects (including elevation of carboxyhemoglobin), central nervous system effects, liver effects, and skin and eye irritation.

(iii) Employers shall include MC in the hazard communication program established to comply with the HCS (§ 1910.1200). Employers shall ensure that each employee has access to labels on containers of MC and to safety data sheets, and is trained in accordance with the requirements of HCS and paragraph (l) of this section.

(2) [Reserved]

* * * * *

■ 32. Amend § 1910.1200 as follows:
■ A. Remove the word "material" before the word "safety" in the phrase "material safety data sheet" or "material safety data sheets" wherever they appear in paragraphs (b)(3)(ii), (b)(4)(ii), (e)(1) introductory text, (e)(2)(i), (g)(4), (g)(6)(i) through (iv), (g)(7)(i) through (vii), (g)(9), (g)(11), (h)(1), (h)(2)(iii), and (i)(1)(ii);
■ B. Remove the word "Material" before the word "safety" in the phrase "Material safety data sheets" wherever they appear in paragraphs (g)(10) and (g)(11). In paragraphs (g)(10) and (g)(11) in the first sentence, capitalize the first letter of the word "safety".
■ C. Remove the following definitions in paragraph (c) *Combustible liquid, Compressed gas, Explosive, Flammable, Flashpoint, Hazard warning, Identity, Material safety data sheet (MSDS), Organic peroxide, Oxidizer, Pyrophoric, Unstable (reactive),* and *Water-reactive;*
■ D. Revise the following definitions in paragraph (c) *Chemical, Chemical name, Health hazard, Label, Mixture, Physical hazard,* and *Trade secret;*
■ E. Redesignate the definition of the term *Hazardous chemical* in alphabetical order in paragraph (c) and revise the definition;
■ F. Add the following definitions in alphabetical order in paragraph (c) *Classification, Hazard category, Hazard class, Hazard not otherwise classified, Hazard statement, Label elements, Pictogram, Precautionary statement, Product identifier, Pyrophoric gas, Safety Data Sheet (SDS), Signal word, Simple asphyxiant,* and *Substance;*
■ G. Remove the following phrases: "in" before the phrase "in their work area(s)"

in paragraph (g)(10); "specific chemical identity" in paragraph (i)(10)(ii); and "or percentage of mixture" in paragraph (i)(13);

■ H. Revise paragraphs (a), (b)(1), (b)(3)(iv), (b)(5)(iv), (b)(6)(ii), paragraph (d) (heading), paragraphs (d)(1) through (d)(3), (e)(1)(i), (f), paragraph (g) (heading), paragraphs (g)(1), (g)(2), (g)(3), (g)(5), (g)(8), (g)(11), (h)(1), (h)(3)(ii), (h)(3)(iv), (i)(1) introductory text, (i)(1)(iii) and (iv), (i)(2), (i)(3) introductory text, (i)(3)(iii), (i)(7) introductory text, (i)(7)(iii), (i)(7)(v), (i)(9)(i), (i)(10), (i)(11), and (j).

■ I. Remove Appendices A, B, and E to § 1910.1200.

■ J. Redesignate Appendix D to § 1910.1200 as Appendix E to § 1910.1200.

■ K. Add new Appendices A, B, C, D and F to § 1910.1200.

The revisions and additions read as follows:

§ 1910.1200 Hazard communication.

(a) *Purpose.* (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 Labelling 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.

(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.

(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.)

* * * * *

(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.

* * * * *

(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;

* * * * *

(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.

* * * * *

(c) * * *

Chemical means any substance, or mixture of substances.

* * * * *

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.

* * * * *

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.

* * * * *

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.

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.

* * * * *

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.

* * * * *

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.

* * * * *

(d) *Hazard classification.* (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.

(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.

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

(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.

* * * * *

(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,

* * * * *

(f) *Labels and other forms of warning*—(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:

(i) Product identifier;

(ii) Signal word;

(iii) Hazard statement(s);

(iv) Pictogram(s);

(v) Precautionary statement(s); and,

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

(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).

(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.

(4) *Solid materials.* (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;

(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,

(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).

(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.

(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:

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

(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.

(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.

(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.

(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.

(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.

(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.

(g) *Safety data sheets.* (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.

(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):

(i) Section 1, Identification;

(ii) Section 2, Hazard(s) identification;

(iii) Section 3, Composition/information on ingredients;

(iv) Section 4, First-aid measures;

(v) Section 5, Fire-fighting measures;

(vi) Section 6, Accidental release measures;

(vii) Section 7, Handling and storage;

(viii) Section 8, Exposure controls/personal protection;

(ix) Section 9, Physical and chemical properties;

(x) Section 10, Stability and reactivity;

(xi) Section 11, Toxicological information;

(xii) Section 12, Ecological information;

(xiii) Section 13, Disposal considerations;

(xiv) Section 14, Transport information;

(xv) Section 15, Regulatory information; and

(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.

(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.

* * * * *

(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.

* * * * *

(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.)

* * * * *

(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).

(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.

* * * * *

(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;

* * * * *

(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.

(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:

* * * * *

(iii) The safety data sheet indicates that the specific chemical identity and/or percentage of composition is being withheld as a trade secret; and,

(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).

(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.

(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:

* * * * *

(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:

* * * * *

(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:

* * * * *

(iii) Include evidence to support the claim that the specific chemical identity or percent of composition is a trade secret;

* * * * *

(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the trade secret.

* * * * *

(9) * * *

(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity or percentage composition is a trade secret;

* * * * *

(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.

(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.

(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.

* * * * *

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

(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:

(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.

(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.

(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.

Appendix A to § 1910.1200—Health Hazard Criteria (Mandatory)

A.0 GENERAL CLASSIFICATION CONSIDERATIONS

A.0.1 Classification

A.0.1.1 The term "hazard classification" is used to indicate that only the intrinsic hazardous properties of chemicals are considered. Hazard classification incorporates three steps:

(a) Identification of relevant data regarding the hazards of a chemical;

(b) Subsequent review of those data to ascertain the hazards associated with the chemical;

(c) Determination of whether the chemical will be classified as hazardous and the degree of hazard.

A.0.1.2 For many hazard classes, the criteria are semi-quantitative or qualitative and expert judgment is required to interpret the data for classification purposes.

A.0.2 Available Data, Test Methods and Test Data Quality

A.0.2.1 There is no requirement for testing chemicals.

A.0.2.2 The criteria for determining health hazards are test method neutral, i.e., they do not specify particular test methods, as long as the methods are scientifically validated.

A.0.2.3 The term "scientifically validated" refers to the process by which the reliability and the relevance of a procedure are established for a particular purpose. Any test that determines hazardous properties, which is conducted according to recognized scientific principles, can be used for purposes of a hazard determination for health hazards. Test conditions need to be standardized so that the results are reproducible with a given substance, and the standardized test yields "valid" data for defining the hazard class of concern.

A.0.2.4 Existing test data are acceptable for classifying chemicals, although expert judgment also may be needed for classification purposes.

A.0.2.5 The effect of a chemical on biological systems is influenced, by the physico-chemical properties of the substance and/or ingredients of the mixture and the way in which ingredient substances are biologically available. A chemical need not be classified when it can be shown by conclusive experimental data from scientifically validated test methods that the chemical is not biologically available.

A.0.2.6 For classification purposes, epidemiological data and experience on the effects of chemicals on humans (e.g., occupational data, data from accident databases) shall be taken into account in the evaluation of human health hazards of a chemical.

A.0.3 Classification Based on Weight of Evidence

A.0.3.1 For some hazard classes, classification results directly when the data satisfy the criteria. For others, classification of a chemical shall be determined on the basis of the total weight of evidence using expert judgment. This means that all available information bearing on the classification of hazard shall be considered together, including the results of valid *in vitro* tests, relevant animal data, and human experience such as epidemiological and clinical studies and well-documented case reports and observations.

A.0.3.2 The quality and consistency of the data shall be considered. Information on chemicals related to the material being classified shall be considered as appropriate, as well as site of action and mechanism or mode of action study results. Both positive and negative results shall be considered together in a single weight-of-evidence determination.

A.0.3.3 Positive effects which are consistent with the criteria for classification, whether seen in humans or animals, shall normally justify classification. Where evidence is available from both humans and animals and there is a conflict between the findings, the quality and reliability of the evidence from both sources shall be evaluated in order to resolve the question of classification. Reliable, good quality human data shall generally have precedence over other data. However, even well-designed and conducted epidemiological studies may lack a sufficient number of subjects to detect relatively rare but still significant effects, or to assess potentially confounding factors. Therefore, positive results from well-conducted animal studies are not necessarily negated by the lack of positive human experience but require an assessment of the robustness, quality and statistical power of both the human and animal data.

A.0.3.4 Route of exposure, mechanistic information, and metabolism studies are pertinent to determining the relevance of an effect in humans. When such information raises doubt about relevance in humans, a lower classification may be warranted. When there is scientific evidence demonstrating that the mechanism or mode of action is not relevant to humans, the chemical should not be classified.

A.0.3.5 Both positive and negative results are considered together in the weight of evidence determination. However, a single positive study performed according to good scientific principles and with statistically and biologically significant positive results may justify classification.

A.0.4 Considerations for the Classification of Mixtures

A.0.4.1 For most hazard classes, the recommended process of classification of mixtures is based on the following sequence:

(a) Where test data are available for the complete mixture, the classification of the mixture will always be based on those data;

(b) Where test data are not available for the mixture itself, the bridging principles designated in each health hazard chapter of this appendix shall be considered for classification of the mixture;

(c) If test data are not available for the mixture itself, and the available information is not sufficient to allow application of the above-mentioned bridging principles, then the method(s) described in each chapter for estimating the hazards based on the information known will be applied to classify the mixture (e.g., application of cut-off values/concentration limits).

A.0.4.2 An exception to the above order or precedence is made for Carcinogenicity, Germ Cell Mutagenicity, and Reproductive Toxicity. For these three hazard classes, mixtures shall be classified based upon information on the ingredient substances, unless on a case-by-case basis, justification can be provided for classifying based upon the mixture as a whole. See chapters A.5, A.6, and A.7 for further information on case-by-case bases.

A.0.4.3 Use of cut-off values/concentration limits.

A.0.4.3.1 When classifying an untested mixture based on the hazards of its ingredients, cut-off values/concentration limits for the classified ingredients of the mixture are used for several hazard classes. While the adopted cut-off values/concentration limits adequately identify the hazard for most mixtures, there may be some that contain hazardous ingredients at lower concentrations than the specified cut-off values/concentration limits that still pose an identifiable hazard. There may also be cases where the cut-off value/concentration limit is considerably lower than the established non-hazardous level for an ingredient.

A.0.4.3.2 If the classifier has information that the hazard of an ingredient will be evident (i.e., it presents a health risk) below the specified cut-off value/concentration limit, the mixture containing that ingredient shall be classified accordingly.

A.0.4.3.3 In exceptional cases, conclusive data may demonstrate that the hazard of an ingredient will not be evident (i.e., it does not present a health risk) when present at a level above the specified cut-off value/concentration limit(s). In these cases the mixture may be classified according to those data. The data must exclude the possibility that the ingredient will behave in the mixture in a manner that would increase the hazard over that of the pure substance. Furthermore, the mixture must not contain ingredients that would affect that determination.

A.0.4.4 Synergistic or antagonistic effects.

When performing an assessment in accordance with these requirements, the evaluator must take into account all available information about the potential occurrence of synergistic effects among the ingredients of the mixture. Lowering classification of a mixture to a less hazardous category on the basis of antagonistic effects may be done only if the determination is supported by sufficient data.

A.0.5 Bridging Principles for the Classification of Mixtures Where Test Data Are Not Available for the Complete Mixture

A.0.5.1 Where the mixture itself has not been tested to determine its toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles, subject to any specific provisions for mixtures for each hazard class. These principles ensure that the classification process uses the available data to the greatest extent possible in characterizing the hazards of the mixture.

A.0.5.1.1 Dilution.

For mixtures classified in accordance with A.1 through A.10 of this Appendix, if a tested mixture is diluted with a diluent that has an equivalent or lower toxicity classification than the least toxic original ingredient, and which is not expected to affect the toxicity of other ingredients, then:

(a) The new diluted mixture shall be classified as equivalent to the original tested mixture; or

(b) For classification of acute toxicity in accordance with A.1 of this Appendix, paragraph A.1.3.6 (the additivity formula) shall be applied.

A.0.5.1.2 Batching.

For mixtures classified in accordance with A.1 through A.10 of this Appendix, the toxicity of a tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same mixture, when produced by or under the control of the same *chemical manufacturer*, unless there is reason to believe there is significant variation such that the toxicity of the untested batch has changed. If the latter occurs, a new classification is necessary.

A.0.5.1.3 Concentration of mixtures.

For mixtures classified in accordance with A.1, A.2, A.3, A.8, A.9, or A.10 of this Appendix, if a tested mixture is classified in Category 1, and the concentration of the ingredients of the tested mixture that are in Category 1 is increased, the resulting untested mixture shall be classified in Category 1.

A.0.5.1.4 Interpolation within one toxicity category.

For mixtures classified in accordance with A.1, A.2, A.3, A.8, A.9, or A.10 of this Appendix, for three mixtures (A, B and C) with identical ingredients, where mixtures A and B have been tested and are in the same toxicity category, and where untested mixture C has the same toxicologically active ingredients as mixtures A and B but has concentrations of toxicologically active ingredients intermediate to the concentrations in mixtures A and B, then mixture C is assumed to be in the same toxicity category as A and B.

A.0.5.1.5 Substantially similar mixtures.

For mixtures classified in accordance with A.1 through A.10 of this Appendix, given the following set of conditions:

(a) Where there are two mixtures:

(i) A + B;

(ii) C + B;

(b) The concentration of ingredient B is essentially the same in both mixtures;

(c) The concentration of ingredient A in mixture (i) equals that of ingredient C in mixture (ii);

(d) And data on toxicity for A and C are available and substantially equivalent; i.e., they are in the same hazard category and are not expected to affect the toxicity of B; then

If mixture (i) or (ii) is already classified based on test data, the other mixture can be assigned the same hazard category.

A.0.5.1.6 Aerosols.

For mixtures classified in accordance with A.1, A.2, A.3, A.4, A.8, or A.9 of this Appendix, an aerosol form of a mixture shall be classified in the same hazard category as the tested, non-aerosolized form of the mixture, provided the added propellant does not affect the toxicity of the mixture when spraying.

A.1 ACUTE TOXICITY

A.1.1 Definition

Acute toxicity refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.

A.1.2 Classification Criteria for Substances

A.1.2.1 Substances can be allocated to one of four toxicity categories based on acute toxicity by the oral, dermal or inhalation route according to the numeric cut-off criteria as shown in Table A.1.1. Acute toxicity values are expressed as (approximate) LD50 (oral, dermal) or LC50 (inhalation) values or as acute toxicity estimates (ATE). See the footnotes following Table A.1.1 for further explanation on the application of these values.

TABLE A.1.1—ACUTE TOXICITY HAZARD CATEGORIES AND ACUTE TOXICITY ESTIMATE (ATE) VALUES DEFINING THE RESPECTIVE CATEGORIES

Exposure route	Category 1	Category 2	Category 3	Category 4
Oral (mg/kg bodyweight) *see: Note (a), Note (b)*	≤5	>5 and ≤50	>50 and ≤300	>300 and ≤2000.
Dermal (mg/kg bodyweight) *see: Note (a), Note (b)*	≤5	>50 and ≤200	>200 and ≤1000	>1000 and ≤2000.
Inhalation—Gases (ppmV) *see: Note (a), Note (b), Note (c)*	≤100	>100 and ≤500	>500 and ≤2500	>2500 and ≤20000.
Inhalation—Vapors (mg/l) *see: Note (a), Note (b), Note (c), Note (d).*	≤0.5	>0.5 and ≤2.0	>2.0 and ≤10.0	>10.0 and ≤20.0.
Inhalation—Dusts and Mists (mg/l) *see: Note (a), Note (b), Note (c)*	≤0.05	>0.05 and ≤0.5	>0.5 and ≤1.0	>1.0 and ≤5.0.

Note: *Gas concentrations are expressed in parts per million per volume (ppmV).*

Notes to Table A.1.1:

(a) The acute toxicity estimate (ATE) for the classification of a substance is derived using the LD_{50}/LC_{50} Stewardwhere available;

(b) The acute toxicity estimate (ATE) for the classification of a substance or ingredient in a mixture is derived using:

(i) the LD_{50}/LC_{50} where available. Otherwise,

(ii) the appropriate conversion value from Table 1.2 that relates to the results of a range test, or

(iii) the appropriate conversion value from Table 1.2 that relates to a classification category;

(c) Inhalation cut-off values in the table are based on 4 hour testing exposures. Conversion of existing inhalation toxicity data which has been generated according to 1 hour exposure is achieved by dividing by a factor of 2 for gases and vapors and 4 for dusts and mists;

(d) For some substances the test atmosphere will be a vapor which consists of a combination of liquid and gaseous phases. For other substances the test atmosphere may consist of a vapor which is nearly all the gaseous phase. In these latter cases, classification is based on ppmV as follows: Category 1 (100 ppmV), Category 2 (500 ppmV), Category 3 (2500 ppmV), Category 4 (20000 ppmV).

The terms "dust", "mist" and "vapor" are defined as follows:

(i) Dust: solid particles of a substance or mixture suspended in a gas (usually air);

(ii) Mist: liquid droplets of a substance or mixture suspended in a gas (usually air);

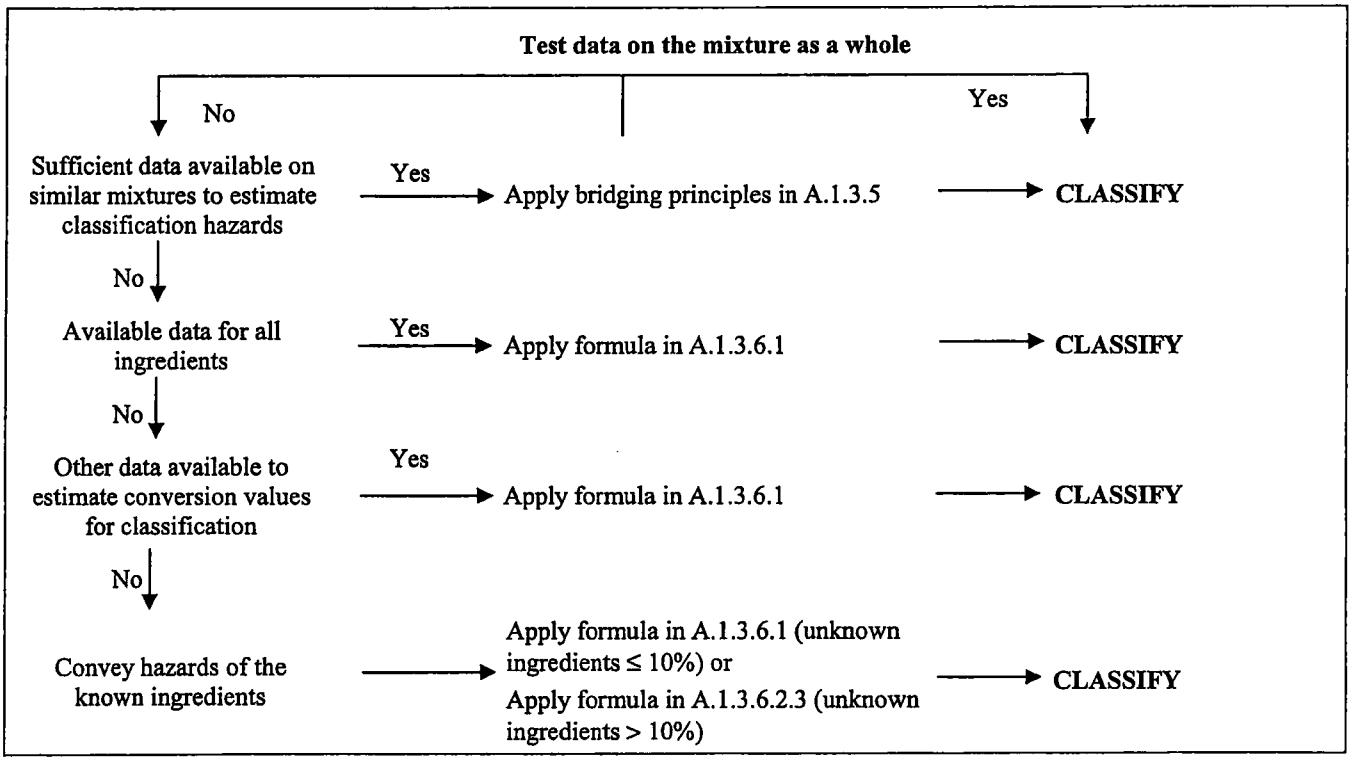
(iii) Vapor: the gaseous form of a substance or mixture released from its liquid or solid state.

A.1.2.3 The preferred test species for evaluation of acute toxicity by the oral and inhalation routes is the rat, while the rat or rabbit are preferred for evaluation of acute dermal toxicity. Test data already generated for the classification of chemicals under existing systems should be accepted when reclassifying these chemicals under the harmonized system. When experimental data for acute toxicity are available in several animal species, scientific judgment should be used in selecting the most appropriate LD_{50} value from among scientifically validated tests.

A.1.3 Classification Criteria for Mixtures

A.1.3.1 The approach to classification of mixtures for acute toxicity is tiered, and is dependent upon the amount of information available for the mixture itself and for its ingredients. The flow chart of Figure A.1.1 indicates the process that must be followed:

Figure A.1.1: Tiered approach to classification of mixtures for acute toxicity



A.1.3.2 Classification of mixtures for acute toxicity may be carried out for each route of exposure, but is only required for one route of exposure as long as this route is followed (estimated or tested) for all ingredients and there is no relevant evidence to suggest acute toxicity by multiple routes. When there is relevant evidence of acute toxicity by multiple routes of exposure, classification is to be conducted for all appropriate routes of exposure. All available information shall be considered. The pictogram and signal word used shall reflect the most severe hazard category; and all relevant hazard statements shall be used.

A.1.3.3 For purposes of classifying the hazards of mixtures in the tiered approach:

(a) The "relevant ingredients" of a mixture are those which are present in concentrations ≥1% (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases). If there is reason to suspect that an ingredient present at a concentration <1% will affect classification of the mixture for acute toxicity, that ingredient shall also be considered relevant. Consideration of ingredients present at a concentration <1% is particularly important when classifying untested mixtures which contain ingredients that are classified in Category 1 and Category 2;

(b) Where a classified mixture is used as an ingredient of another mixture, the actual or derived acute toxicity estimate (ATE) for that mixture is used when calculating the classification of the new mixture using the formulas in A.1.3.6.1 and A.1.3.6.2.4.

(c) If the converted acute toxicity point estimates for all ingredients of a mixture are within the same category, then the mixture should be classified in that category.

(d) When only range data (or acute toxicity hazard category information) are available for ingredients in a mixture, they may be converted to point estimates in accordance with Table A.1.2 when calculating the classification of the new mixture using the formulas in A.1.3.6.1 and A.1.3.6.2.4.

A.1.3.4 Classification of Mixtures Where Acute Toxicity Test Data Are Available for the Complete Mixture

Where the mixture itself has been tested to determine its acute toxicity, it is classified according to the same criteria as those used for substances, presented in Table A.1.1. If test data for the mixture are not available, the procedures presented below must be followed.

A.1.3.5 Classification of Mixtures Where Acute Toxicity Test Data Are Not Available for the Complete Mixture: Bridging Principles

A.1.3.5.1 Where the mixture itself has not been tested to determine its acute toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.1.3.6 Classification of Mixtures Based on Ingredients of the Mixture (Additivity Formula)

A.1.3.6.1 Data available for all ingredients.

The acute toxicity estimate (ATE) of ingredients is considered as follows:

(a) Include ingredients with a known acute toxicity, which fall into any of the acute toxicity categories, or have an oral or dermal LD_{50} greater than 2000 but less than or equal to 5000 mg/kg body weight (or the equivalent dose for inhalation);

(b) Ignore ingredients that are presumed not acutely toxic (e.g., water, sugar);

(c) Ignore ingredients if the data available are from a limit dose test (at the upper threshold for Category 4 for the appropriate route of exposure as provided in Table A.1.1) and do not show acute toxicity.

Ingredients that fall within the scope of this paragraph are considered to be ingredients with a known acute toxicity estimate (ATE). See note (b) to Table A.1.1 and paragraph A.1.3.3 for appropriate application of available data to the equation below, and paragraph A.1.3.6.2.4.

The ATE of the mixture is determined by calculation from the ATE values for all relevant ingredients according to the following formula below for oral, dermal or inhalation toxicity:

$$\frac{100}{ATEmix} = \sum_{n} \frac{Ci}{ATE_i}$$

Where:

Ci = concentration of ingredient i

n ingredients and i is running from 1 to n

ATEi = acute toxicity estimate of ingredient i.

A.1.3.6.2 Data are not available for one or more ingredients of the mixture.

A.1.3.6.2.1 Where an ATE is not available for an individual ingredient of the mixture, but available information provides a derived conversion value, the formula in A.1.3.6.1 may be applied. This information may include evaluation of:

(a) Extrapolation between oral, dermal and inhalation acute toxicity estimates. Such an evaluation requires appropriate pharmacodynamic and pharmacokinetic data;

(b) Evidence from human exposure that indicates toxic effects but does not provide lethal dose data;

(c) Evidence from any other toxicity tests/assays available on the substance that indicates toxic acute effects but does not necessarily provide lethal dose data; or

(d) Data from closely analogous substances using structure/activity relationships.

A.1.3.6.2.2 This approach requires substantial supplemental technical information, and a highly trained and experienced expert, to reliably estimate acute toxicity. If sufficient information is not available to reliably estimate acute toxicity, proceed to the provisions of A.1.3.6.2.3.

A.1.3.6.2.3 In the event that an ingredient with unknown acute toxicity is used in a mixture at a concentration ≥1%, and the mixture has not been classified based on testing of the mixture as a whole, the mixture cannot be attributed a definitive acute toxicity estimate. In this situation the mixture is classified based on the known ingredients only. (Note: A statement that × percent of the mixture consists of ingredient(s) of unknown toxicity is required on the label and safety data sheet in such cases; see Appendix C to this section, Allocation of Label Elements and Appendix D to this section, Safety Data Sheets.)

Where an ingredient with unknown acute toxicity is used in a mixture at a concentration ≥1%, and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required on the label and safety data sheet in such cases; see Appendix C to this section, Allocation of Label Elements and Appendix D to this section, Safety Data Sheets.)

A.1.3.6.2.4 If the total concentration of the relevant ingredient(s) with unknown acute toxicity is ≤10% then the formula presented in A.1.3.6.1 must be used. If the total concentration of the relevant ingredient(s) with unknown acute toxicity is >10%, the formula presented in A.1.3.6.1 is corrected to adjust for the percentage of the unknown ingredient(s) as follows:

$$\frac{100-\left(\sum C_{unknown} \text{ if } >10\%\right)}{ATE_{mix}} = \sum_{n} \frac{Ci}{ATE_i}$$

TABLE A.1.2—CONVERSION FROM EXPERIMENTALLY OBTAINED ACUTE TOXICITY RANGE VALUES (OR ACUTE TOXICITY HAZARD CATEGORIES) TO ACUTE TOXICITY POINT ESTIMATES FOR USE IN THE FORMULAS FOR THE CLASSIFICATION OF MIXTURES

Exposure routes	Classification category or experimentally obtained acute toxicity range estimate	Converted acute toxicity point estimate
Oral (mg/kg bodyweight)	0 <Category 1 ≤5	0.5
	5 <Category 2 ≤50	5
	50 <Category 3 ≤300	100
	300 <Category 4 ≤2000	500
Dermal (mg/kg bodyweight)	0 <Category 1 ≤50	5
	50 <Category 2 ≤200	50
	200 <Category 3 ≤1000	300
	1000 <Category 4 ≤2000	1100
Gases (ppmV)	0 <Category 1 ≤100	10
	100 <Category 2 ≤500	100
	500 <Category 3 ≤2500	700
	2500 <Category 4 ≤20000	4500
Vapors (mg/l)	0 <Category 1 ≤0.5	0.05
	0.5 <Category 2 ≤2.0	0.5
	2.0 <Category 3 ≤10.0	3
	10.0 <Category 4 ≤20.0	11
Dust/mist (mg/l)	0 <Category 1 ≤0.05	0.005
	0.05 <Category 2 ≤0.5	0.05
	0.5 <Category 3 ≤1.0	0.5
	1.0 <Category 4 ≤5.0	1.5

Note: Gas concentrations are expressed in parts per million per volume (ppmV).

A.2 SKIN CORROSION/IRRITATION

A.2.1 Definitions and General Considerations

A.2.1.1 *Skin corrosion* is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours. Corrosive reactions are typified by ulcers, bleeding, bloody scabs, and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of alopecia, and scars. Histopathology should be considered to evaluate questionable lesions.

Skin irritation is the production of reversible damage to the skin following the application of a test substance for up to 4 hours.

A.2.1.2 Skin corrosion/irritation shall be classified using a tiered approach as detailed in figure A.2.1. Emphasis shall be placed upon existing human data (See A.0.2.6), followed by other sources of information. Classification results directly when the data satisfy the criteria in this section. In case the criteria cannot be directly applied, classification of a substance or a mixture is made on the basis of the total weight of evidence (See A.0.3.1). This means that all available information bearing on the determination of skin corrosion/irritation is considered together, including the results of appropriate scientifically validated in-vitro tests, relevant animal data, and human data such as epidemiological and clinical studies and well-documented case reports and observations.

A.2.2 Classification Criteria for Substances Using Animal Test Data

A.2.2.1 Corrosion

A.2.2.1.1 A corrosive substance is a chemical that produces destruction of skin tissue, namely, visible necrosis through the epidermis and into the dermis, in at least 1 of 3 tested animals after exposure up to a 4-hour duration. Corrosive reactions are typified by ulcers, bleeding, bloody scabs and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of alopecia and scars. Histopathology should be considered to discern questionable lesions.

A.2.2.1.2 Three sub-categories of Category 1 are provided in Table A.2.1, all of which shall be regulated as Category 1.

TABLE A.2.1—SKIN CORROSION CATEGORY AND SUB-CATEGORIES

Category 1: corrosive	Corrosive sub-categories	Corrosive in ≥1 of 3 animals	
		Exposure	Observation
	1A	≤3 min	≤1 h.
	1B	>3 min ≤1 h	≤14 days.
	1C	>1 h ≤4 h	≤14 days.

A.2.2.2 Irritation

A.2.2.2.1 A single irritant category (Category 2) is presented in the Table A.2.2. The major criterion for the irritant category is that at least 2 tested animals have a mean score of ≥2.3 ≤4.0.

TABLE A.2.2—SKIN IRRITATION CATEGORY

	Criteria
Irritant (Category 2)	(1) Mean value of ≥2.3 ≤4.0 for erythema/eschar or for edema in at least 2 of 3 tested animals from gradings at 24, 48 and 72 hours after patch removal or, if reactions are delayed, from grades on 3 consecutive days after the onset of skin reactions; or (2) Inflammation that persists to the end of the observation period normally 14 days in at least 2 animals, particularly taking into account alopecia (limited area), hyperkeratosis, hyperplasia, and scaling; or (3) In some cases where there is pronounced variability of response among animals, with very definite positive effects related to chemical exposure in a single animal but less than the criteria above.

A.2.2.2.2 Animal irritant responses within a test can be quite variable, as they are with corrosion. A separate irritant criterion accommodates cases when there is a significant irritant response but less than the mean score criterion for a positive test. For example, a substance might be designated as an irritant if at least 1 of 3 tested animals shows a very elevated mean score throughout the study, including lesions persisting at the end of an observation period of normally 14 days. Other responses could also fulfil this criterion. However, it should be ascertained that the responses are the result of chemical exposure. Addition of this criterion increases the sensitivity of the classification system.

A.2.2.2.3 Reversibility of skin lesions is another consideration in evaluating irritant responses. When inflammation persists to the end of the observation period in 2 or more test animals, taking into consideration alopecia (limited area), hyperkeratosis, hyperplasia and scaling, then a chemical should be considered to be an irritant.

A.2.3 Classification Criteria for Substances Using Other Data Elements

A.2.3.1 Existing human and animal data including information from single or repeated exposure should be the first line of analysis, as they give information directly relevant to effects on the skin. If a substance is highly toxic by the dermal route, a skin corrosion/irritation study may not be practicable since the amount of test substance to be applied would considerably exceed the toxic dose and, consequently, would result in the death of the animals. When observations are made of skin corrosion/irritation in acute toxicity studies and are observed up through the limit dose, these data may be used for classification provided that the dilutions used and species tested are equivalent. *In vitro* alternatives that have been scientifically validated shall be used to make classification decisions. Solid substances (powders) may become corrosive or irritant when moistened or in contact with moist skin or mucous membranes. Likewise, pH extremes like ≤2 and ≥11.5 may indicate skin effects, especially when associated with significant buffering capacity. Generally, such substances are expected to produce significant effects on the skin. In the absence of any other information, a substance is considered corrosive (Skin Category 1) if it has a pH ≤2 or a pH ≥11.5. However, if consideration of alkali/acid reserve suggests the substance or mixture may not be corrosive despite the low or high pH value, then further evaluation may be necessary. In some cases enough information may be available from structurally related compounds to make classification decisions.

A.2.3.2 A *tiered approach* to the evaluation of initial information shall be used (Figure A.2.1) recognizing that all elements may not be relevant in certain cases.

A.2.3.3 The tiered approach explains how to organize information on a substance and to make a weight-of-evidence decision about hazard assessment and hazard classification.

A.2.3.4 All the above information that is available on a substance shall be evaluated. Although information might be gained from the evaluation of single parameters within a

tier, there is merit in considering the totality of existing information and making an overall weight of evidence determination. This is especially true when there is information available on some but not all parameters. Emphasis shall be placed upon existing human experience and data, followed by animal experience and testing data, followed by other sources of information, but case-by-case determinations are necessary.

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Figure A.2.1: Tiered evaluation of skin corrosion and irritation potential

Step	Parameter	Finding	Conclusion
1a	Existing human or animal data[1]	Skin corrosive	Category 1[2]
	↓ Not corrosive or no data		
1b	Existing human or animal data[1]	Skin irritant	Category 2[2]
	↓ Not an irritant or no data		
1c	Existing human or animal data[1]	Not a skin corrosive or skin irritant	Not classified
	↓ No/Insufficient data		
2:	Other, existing skin data in animals[3]	Skin corrosive Skin irritant	Category 1[2] Category 2[2]
	↓ No/Insufficient data		
3:	Existing skin corrosive *ex vivo / in vitro* data[4]	Positive: Skin corrosive	Category 1[2]
	↓ Not corrosive or no data		
	Existing skin irritation *ex vivo / in vitro* data[4]	Positive: Skin irritant Negative: Not a skin irritant[5]	Category 2[2] Not classified
	↓ No/Insufficient data		
4:	pH-Based assessment (with consideration of buffering capacity of the chemical, or no buffering capacity data)[5]	pH ≤ 2 or ≥ 11.5	Category 1[2]
	↓ Not a pH extreme, No pH data or extreme pH with low/no buffering capacity		
5:	Validated Structure/Activity Relationship (SAR) models	Skin corrosive Skin irritant	Category 1[2] Category 2[2]
	↓ No/Insufficient data		
6:	Consideration of the total Weight of Evidence[6]	Skin corrosive Skin irritant	Category 1[2] Category 2[2]
	↓ No concern based on consideration of the sum of available data		
7:	**Not Classified**		Not classified

Notes to Figure A.2.1:

[1] *Evidence of existing human or animal data may be derived from single or repeated exposure(s) in occupational, consumer, transportation, or emergency response scenarios; from ethically-conducted human clinical studies; or from purposely-generated data from animal studies conducted according to scientifically validated test methods (at present, there is no internationally accepted test method for human skin irritation testing).*

[2] *Classify in the appropriate harmonized category, as shown in Tables A.2.1 and A.2.2.*

[3] *Pre-existing animal data (e.g. from an acute dermal toxicity test or a sensitisation test) should be carefully reviewed to determine if sufficient skin corrosion/irritation evidence is available through other, similar information. For example, classification/categorization may be done on the basis of whether a chemical has or has not produced any skin irritation in an acute dermal toxicity test in animals at the limit dose, or produces very toxic effects in an acute dermal toxicity test in animals. In the latter case, the chemical would be classified as being very hazardous by the dermal route for acute toxicity, and it would be moot whether the chemical is also irritating or corrosive on the skin. It should be kept in mind in evaluating acute dermal toxicity information that the reporting of dermal lesions may be incomplete, testing and observations may be made on a species other than the rabbit, and species may differ in sensitivity in their responses.*

[4] *Evidence from studies using scientifically validated protocols with isolated human/animal tissues or other, non-tissue-based, though scientifically validated, protocols should be assessed. Examples of scientifically validated test methods for skin corrosion include OECD TG 430 (Transcutaneous Electrical Resistance Test (TER)), 431 (Human Skin Model Test), and 435 (Membrane Barrier Test Method). OECD TG 439 (Reconstructed Human Epidermis Test Method) is a scientifically validated in vitro test method for skin irritation.*

[5] *Measurement of pH alone may be adequate, but assessment of acid or alkali reserve (buffering capacity) would be preferable. Presently, there is no scientifically validated and internationally accepted method for assessing this parameter.*

[6] *All information that is available on a chemical should be considered and an overall determination made on the total weight of evidence. This is especially true when there is conflict in information available on some parameters. Professional judgment should be exercised in making such a determination.*

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A.2.4 Classification Criteria for Mixtures

A.2.4.1 Classification of Mixtures When Data Are Available for the Complete Mixture

A.2.4.1.1 The mixture shall be classified using the criteria for substances (See A.2.3).

A.2.4.2 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.2.4.2.1 Where the mixture itself has not been tested to determine its skin corrosion/irritation, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles, as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.2.4.3 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.2.4.3.1 For purposes of classifying the skin corrosion/irritation hazards of mixtures in the tiered approach:

The "relevant ingredients" of a mixture are those which are present in concentrations >1% (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases.) If the classifier has reason to suspect that an ingredient present at a concentration <1% will affect classification of the mixture for skin corrosion/irritation, that ingredient shall also be considered relevant.

A.2.4.3.2 In general, the approach to classification of mixtures as irritant or corrosive to skin when data are available on the ingredients, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant ingredient contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive ingredients when they are present at a concentration below the concentration limit for classification with Category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as corrosive or irritant when the sum of the concentrations of such ingredients exceeds a cut-off value/concentration limit.

A.2.4.3.3 Table A.2.3 below provides the cut-off value/concentration limits to be used to determine if the mixture is considered to be an irritant or a corrosive to the skin.

A.2.4.3.4 Particular care shall be taken when classifying certain types of chemicals such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in A.2.4.3.1 and A.2.4.3.2 might not work given that many of such substances are corrosive or irritant at concentrations <1%. For mixtures containing strong acids or bases the pH should be used as classification criteria since pH will be a better indicator of corrosion than the concentration limits of Table A.2.3. A mixture containing corrosive or irritant ingredients that cannot be classified based on the additivity approach shown in Table A.2.3, due to chemical characteristics that make this approach unworkable, should be classified as Skin Category 1 if it contains ≥1% of a corrosive ingredient and as Skin Category 2 when it contains ≥3% of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table A.2.3 does not apply is summarized in Table A.2.4 below.

A.2.4.3.5 On occasion, reliable data may show that the skin corrosion/irritation of an ingredient will not be evident when present at a level above the generic concentration cut-off values mentioned in Tables A.2.3 and A.2.4. In these cases the mixture could be classified according to those data (See *Use of cut-off values/concentration limits*, paragraph A.0.4.3 of this Appendix).

A.2.4.3.6 If there are data showing that (an) ingredient(s) may be corrosive or irritant at a concentration of <1% (corrosive) or <3% (irritant), the mixture shall be classified accordingly (See *Use of cut-off values/concentration limits*, paragraph A.0.4.3 of this Appendix).

TABLE A.2.3—CONCENTRATION OF INGREDIENTS OF A MIXTURE CLASSIFIED AS SKIN CATEGORY 1 OR 2 THAT WOULD TRIGGER

[Category 1 or 2]

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Skin corrosive	Skin irritant
	Category 1	Category 2
Skin Category 1	≥5%	≥1% but <5%.
Skin Category 2		≥10%.
(10 × Skin Category 1) + Skin Category 2		≥10%.

TABLE A.2.4—CONCENTRATION OF INGREDIENTS OF A MIXTURE FOR WHICH THE ADDITIVITY APPROACH DOES NOT APPLY, THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS HAZARDOUS TO SKIN

Ingredient:	Concentration:	Mixture classified as: Skin
Acid with pH ≤2	≥1%	Category 1.
Base with pH ≥11.5	≥1%	Category 1.
Other corrosive (Category 1) ingredients for which additivity does not apply	≥1%	Category 1.
Other irritant (Category 2) ingredients for which additivity does not apply, including acids and bases	≥3%	Category 2.

A.3 SERIOUS EYE DAMAGE/EYE IRRITATION

A.3.1 Definitions and General Considerations

A.3.1.1 *Serious eye damage* is the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the anterior surface of the eye, which is not fully reversible within 21 days of application.

Eye irritation is the production of changes in the eye following the application of test substance to the anterior surface of the eye, which are fully reversible within 21 days of application.

A.3.1.2 Serious eye damage/eye irritation shall be classified using a tiered approach as detailed in Figure A.3.1. Emphasis shall be placed upon existing human data (See A.0.2.6), followed by animal data, followed by other sources of information. Classification results directly when the data satisfy the criteria in this section. In case the criteria cannot be directly applied, classification of a substance or a mixture is made on the basis of the total weight of evidence (See A.0.3.1). This means that all available information bearing on the determination of serious eye damage/eye irritation is considered together, including the results of appropriate scientifically validated *in vitro* tests, relevant animal data, and human data such as epidemiological and clinical studies and well-documented case reports and observations.

A.3.2 Classification Criteria for Substances Using Animal Test Data

A.3.2.1 Irreversible effects on the eye/serious damage to eyes (Category 1).

A single hazard category is provided in Table A.3.1, for substances that have the potential to seriously damage the eyes. Category 1, irreversible effects on the eye, includes the criteria listed below. These observations include animals with grade 4 cornea lesions and other severe reactions (e.g. destruction of cornea) observed at any time during the test, as well as persistent corneal opacity, discoloration of the cornea by a dye substance, adhesion, pannus, and interference with the function of the iris or other effects that impair sight. In this context, persistent lesions are considered those which are not fully reversible within an observation period of normally 21 days. Category 1 also contains substances fulfilling the criteria of corneal opacity ≥3 and/or iritis >1.5 detected in a Draize eye test with rabbits, because severe lesions like these usually do not reverse within a 21-day observation period.

TABLE A.3.1—IRREVERSIBLE EYE EFFECTS

A substance is classified as Serious Eye Damage Category 1 (irreversible effects on the eye) when it produces:
(a) at least in one tested animal, effects on the cornea, iris or conjunctiva that are not expected to reverse or have not fully reversed within an observation period of normally 21 days; and/or
(b) at least in 2 of 3 tested animals, a positive response of:
(i) corneal opacity ≥3; and/or
(ii) iritis >1.5;
calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the substance.

A.3.2.2 Reversible effects on the eye (Category 2).

A single category is provided in Table A.3.2 for substances that have the potential to induce reversible eye irritation.

TABLE A.3.2—REVERSIBLE EYE EFFECTS

A substance is classified as Eye Irritant Category 2A (irritating to eyes) when it produces in at least in 2 of 3 tested animals a positive response of:
(i) corneal opacity ≥1; and/or
(ii) iritis ≥1; and/or
(iii) conjunctival redness ≥2; and/or
(iv) conjunctival edema (chemosis) ≥2

TABLE A.3.2—REVERSIBLE EYE EFFECTS—Continued

calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the substance, and which fully reverses within an observation period of normally 21 days.
An eye irritant is considered mildly irritating to eyes (Category 2B) when the effects listed above are fully reversible within 7 days of observation.

A.3.2.3 For those chemicals where there is pronounced variability among animal responses, this information may be taken into account in determining the classification.

A.3.3 Classification Criteria for Substances Using Other Data Elements

A.3.3.1 Existing human and animal data should be the first line of analysis, as they give information directly relevant to effects on the eye. Possible skin corrosion shall be evaluated prior to consideration of serious eye damage/eye irritation in order to avoid testing for local effects on eyes with skin corrosive substances. *In vitro* alternatives that have been scientifically validated and accepted shall be used to make classification decisions. Likewise, pH extremes like ≤2 and ≥11.5, may indicate serious eye damage, especially when associated with significant buffering capacity. Generally, such substances are expected to produce significant effects on the eyes. In the absence of any other information, a mixture/substance is considered to cause serious eye damage (Eye Category 1) if it has a pH ≤2 or ≥11.5. However, if consideration of acid/alkaline reserve suggests the substance may not have the potential to cause serious eye damage despite the low or high pH value, then further evaluation may be necessary. In some cases enough information may be available from structurally related compounds to make classification decisions.

A.3.3.2 A tiered approach to the evaluation of initial information shall be used where applicable, recognizing that all elements may not be relevant in certain cases (Figure A.3.1).

A.3.3.3 The tiered approach explains how to organize existing information on a substance and to make a weight-of-evidence decision, where appropriate, about hazard assessment and hazard classification.

A.3.3.4 All the above information that is available on a substance shall be evaluated. Although information might be gained from the evaluation of single parameters within a tier, consideration should be given to the totality of existing information and making an overall weight-of-evidence determination. This is especially true when there is conflict in information available on some parameters.

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Figure A.3.1 Evaluation strategy for serious eye damage and eye irritation (See also Figure A.2.1)

Step	Parameter	Finding	Conclusion
1a:	Existing human or animal data, eye[1]	→ Serious Eye Damage	→ Category 1[2]
		→ Eye Irritant	→ Category 2[2]
	↓ No/insufficient data or unknown		
1b:	Existing human or animal data, skin corrosion	→ Skin corrosive	→ Category 1[2]
	↓ No/insufficient data or unknown		
1c:	Existing human or animal data, eye[1]	→ Existing data that show that substance does not cause serious eye damage or eye irritation	→ Not Classified
	↓ No/insufficient data		
2:	Other, existing skin/eye data in animals[3]	→ Yes; existing data that show that substance may cause serious eye damage or eye irritation	→ Category1 or Category 2[2]
	↓ No/insufficient data		
3:	Existing *ex vivo / in vitro* data[4]	→ Positive: serious eye damage	→ Category 1[2]
		→ Positive: eye irritant	→ Category 2[2]
	↓ No/insufficient data / negative response		
4:	pH-Based assessment (with consideration of buffering capacity of the chemical, or no buffering capacity data)[5]	→ pH ≤ 2 or ≥11.5	→ Category 1[2]
	↓ Not a pH extreme, no pH data, or extreme pH with low/no buffering capacity		
5:	Validated structure/activity relationship (SAR) models	→ Severe damage to eyes	→ Category 1[2]
		→ Eye irritant	→ Category 2[2]
		→ Skin Corrosive	Category 1[2]
	↓ No/insufficient data		
6:	Consideration of the total weight of evidence[6]	→ Serious eye damage	→ Category 1[2]
		→ Eye irritant	→ Category 2[2]
	↓ No concern based on consideration of the sum of available data		
7:	**Not Classified**		

Notes to Figure A.3.1:

[1] *Evidence of existing human or animal data may be derived from single or repeated exposure(s) in occupational, consumer, transportation, or emergency response scenarios; from ethically-conducted human clinical studies; or from purposely-generated data from animal studies conducted according to scientifically validated test methods. At present, there are no internationally accepted test methods for human skin or eye irritation testing.*

[2] *Classify in the appropriate harmonized category, as shown in Tables A.3.1 and A.3.2.*

[3] *Pre-existing animal data should be carefully reviewed to determine if sufficient skin or eye corrosion/irritation evidence is available through other, similar information.*

[4] *Evidence from studies using scientifically validated protocols with isolated human/animal tissues or other, non-tissue-based, though scientifically validated, protocols should be assessed. Examples of, scientifically validated test methods for identifying eye corrosives and severe irritants (i.e., Serious Eye Damage) include OECD TG 437 (Bovine Corneal Opacity and Permeability (BCOP)) and TG 438 (Isolated Chicken Eye). Positive test results from a scientifically validated in vitro test for skin corrosion would likely also lead to a conclusion to classify as causing Serious Eye Damage.*

[5] *Measurement of pH alone may be adequate, but assessment of acid or alkali reserve (buffering capacity) would be preferable.*

[6] *All information that is available on a chemical should be considered and an overall determination made on the total weight of evidence. This is especially true when there is conflict in information available on some parameters. The weight of evidence including information on skin irritation could lead to classification of eye irritation. It is recognized that not all skin irritants are eye irritants as well. Professional judgment should be exercised in making such a determination.*

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A.3.4 Classification Criteria for Mixtures

A.3.4.1 Classification of Mixtures When Data Are Available for the Complete Mixture

A.3.4.1.1 The mixture will be classified using the criteria for substances.

A.3.4.1.2 Unlike other hazard classes, there are alternative tests available for skin corrosivity of certain types of chemicals that can give an accurate result for classification purposes, as well as being simple and relatively inexpensive to perform. When considering testing of the mixture, chemical manufacturers are encouraged to use a tiered weight of evidence strategy as included in the criteria for classification of substances for skin corrosion and serious eye damage and eye irritation to help ensure an accurate classification, as well as avoid unnecessary animal testing. In the absence of any other information, a mixture is considered to cause serious eye damage (Eye Category 1) if it has a pH ≤2 or ≥11.5. However, if consideration of acid/alkaline reserve suggests the substance or mixture may not have the potential to cause serious eye damage despite the low or high pH value, then further evaluation may be necessary.

A.3.4.2 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.3.4.2.1 Where the mixture itself has not been tested to determine its skin corrosivity or potential to cause serious eye damage or eye irritation, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles, as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.

A.3.4.3 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.3.4.3.1 For purposes of classifying the eye corrosion/irritation hazards of mixtures in the tiered approach:

The "relevant ingredients" of a mixture are those which are present in concentrations >1% (weight/weight for solids, liquids, dusts, mists and vapors and volume/volume for gases). If the classifier has reason to suspect that an ingredient present at a concentration <1% will affect classification of the mixture for eye corrosion/irritation, that ingredient shall also be considered relevant.

A.3.4.3.2 In general, the approach to classification of mixtures as seriously damaging to the eye or eye irritant when data are available on the ingredients, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant ingredient contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive ingredients when they are present at a concentration below the concentration limit for classification with Category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as seriously damaging to the eye or eye irritant when the sum of the concentrations of such ingredients exceeds a threshold cut-off value/concentration limit.

A.3.4.3.3 Table A.3.3 provides the cut-off value/concentration limits to be used to determine if the mixture should be classified as seriously damaging to the eye or an eye irritant.

A.3.4.3.4 Particular care must be taken when classifying certain types of chemicals such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in A.3.4.3.1 and A.3.4.3.2 might not work given that many of such substances are corrosive or irritant at concentrations <1%. For mixtures containing strong acids or bases, the pH should be used as classification criteria (See A.3.4.1) since pH will be a better indicator of serious eye damage than the concentration limits of Table A.3.3. A mixture containing corrosive or irritant ingredients that cannot be classified based on the additivity approach applied in Table A.3.3 due to chemical characteristics that make this approach unworkable, should be classified as Eye Category 1 if it contains ≥1% of a corrosive ingredient and as Eye Category 2 when it contains ≥3% of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table A.3.3 does not apply is summarized in Table A.3.4.

A.3.4.3.5 On occasion, reliable data may show that the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic cut-off values/concentration limits mentioned in Tables A.3.3 and A.3.4. In these cases the mixture could be classified according to those data (See also A.0.4.3 *Use of cut-off values/concentration limits*"). On occasion, when it is expected that the skin corrosion/irritation or the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic concentration/cut-off levels mentioned in Tables A.3.3 and A.3.4, testing of the mixture may be considered. In those cases, the tiered weight of evidence strategy should be applied as referred to in section A.3.3, Figure A.3.1 and explained in detail in this chapter.

A.3.4.3.6 If there are data showing that (an) ingredient(s) may be corrosive or irritant at a concentration of <1% (corrosive) or <3% (irritant), the mixture should be classified accordingly (See also paragraph A.0.4.3, *Use of cut-off values/concentration limits*).

TABLE A.3.3—CONCENTRATION OF INGREDIENTS OF A MIXTURE CLASSIFIED AS SKIN CATEGORY 1 AND/OR EYE CATEGORY 1 OR 2 THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURES AS HAZARDOUS TO THE EYE

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Irreversible eye effects	Reversible eye effects
	Category 1	Category 2
Eye or Skin Category 1	≥3%	≥1% but <3%.

TABLE A.3.3—CONCENTRATION OF INGREDIENTS OF A MIXTURE CLASSIFIED AS SKIN CATEGORY 1 AND/OR EYE CATEGORY 1 OR 2 THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURES AS HAZARDOUS TO THE EYE—Continued

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Irreversible eye effects	Reversible eye effects
	Category 1	Category 2
Eye Category 2		≥10%.
(10 × Eye Category 1) + Eye Category 2		≥10%.
Skin Category 1 + Eye Category 1	≥3%	≥1% but <3%.
10 × (Skin Category 1 + Eye Category 1) + Eye Category 2		≥10%.

Note: *A mixture may be classified as Eye Category 2B in cases when all relevant ingredients are classified as Eye Category 2B.*

TABLE A.3.4—CONCENTRATION OF INGREDIENTS OF A MIXTURE FOR WHICH THE ADDITIVITY APPROACH DOES NOT APPLY, THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS HAZARDOUS TO THE EYE

Ingredient	Concentration	Mixture classified as: Eye
Acid with pH ≤2	≥1%	Category 1.
Base with pH ≥11.5	≥1%	Category 1.
Other corrosive (Category 1) ingredients for which additivity does not apply	≥1%	Category 1.
Other irritant (Category 2) ingredients for which additivity does not apply, including acids and bases	≥3%	Category 2.

A.4 RESPIRATORY OR SKIN SENSITIZATION

A.4.1 Definitions and General Considerations

A.4.1.1 *Respiratory sensitizer* means a chemical that will lead to hypersensitivity of the airways following inhalation of the chemical.

Skin sensitizer means a chemical that will lead to an allergic response following skin contact.

A.4.1.2 For the purpose of this chapter, sensitization includes two phases: the first phase is induction of specialized immunological memory in an individual by exposure to an allergen. The second phase is elicitation, i.e., production of a cell-mediated or antibody-mediated allergic response by exposure of a sensitized individual to an allergen.

A.4.1.3 For respiratory sensitization, the pattern of induction followed by elicitation phases is shared in common with skin sensitization. For skin sensitization, an induction phase is required in which the immune system learns to react; clinical symptoms can then arise when subsequent exposure is sufficient to elicit a visible skin reaction (elicitation phase). As a consequence, predictive tests usually follow this pattern in which there is an induction phase, the response to which is measured by a standardized elicitation phase, typically involving a patch test. The local lymph node assay is the exception, directly measuring the induction response. Evidence of skin sensitization in humans normally is assessed by a diagnostic patch test.

A.4.1.4 Usually, for both skin and respiratory sensitization, lower levels are necessary for elicitation than are required for induction.

A.4.1.5 The hazard class "respiratory or skin sensitization" is differentiated into:

(a) Respiratory sensitization; and

(b) Skin sensitization.

A.4.2 Classification Criteria for Substances

A.4.2.1 Respiratory Sensitizers

A.4.2.1.1 Hazard Categories.

A.4.2.1.1.1 Effects seen in either humans or animals will normally justify classification in a weight of evidence approach for respiratory sensitizers. Substances may be allocated to one of the two sub-categories 1A or 1B using a weight of evidence approach in accordance with the criteria given in Table A.4.1 and on the basis of reliable and good quality evidence from human cases or epidemiological studies and/or observations from appropriate studies in experimental animals.

A.4.2.1.1.2 Where data are not sufficient for sub-categorization, respiratory sensitizers shall be classified in Category 1.

TABLE A.4.1—HAZARD CATEGORY AND SUB-CATEGORIES FOR RESPIRATORY SENSITIZERS

Category 1	Respiratory sensitizer
	A substance is classified as a respiratory sensitizer. (a) if there is evidence in humans that the substance can lead to specific respiratory hypersensitivity and/or (b) if there are positive results from an appropriate animal test.[1]
Sub-category 1A	Substances showing a high frequency of occurrence in humans; or a probability of occurrence of a high sensitization rate in humans based on animal or other tests.[1] Severity of reaction may also be considered.
Sub-category 1B	Substances showing a low to moderate frequency of occurrence in humans; or a probability of occurrence of a low to moderate sensitization rate in humans based on animal or other tests.[1] Severity of reaction may also be considered.

A.4.2.1.2 Human evidence.

A.4.2.1.2.1 Evidence that a substance can lead to specific respiratory hypersensitivity will normally be based on human experience. In this context, hypersensitivity is normally seen as asthma, but other hypersensitivity reactions such as rhinitis/conjunctivitis and alveolitis are also considered. The condition will have the clinical character of an allergic reaction. However, immunological mechanisms do not have to be demonstrated.

A.4.2.1.2.2 When considering the human evidence, it is necessary that in addition to

[1] *At this writing, recognized and validated animal models for the testing of respiratory hypersensitivity are not available. Under certain circumstances, data from animal studies may provide valuable information in a weight of evidence assessment.*

the evidence from the cases, the following be taken into account:

(a) The size of the population exposed;

(b) The extent of exposure.

A.4.2.1.2.3 The evidence referred to above could be:

(a) Clinical history and data from appropriate lung function tests related to exposure to the substance, confirmed by other supportive evidence which may include:

(i) *In vivo* immunological test (e.g., skin prick test);

(ii) *In vitro* immunological test (e.g., serological analysis);

(iii) Studies that may indicate other specific hypersensitivity reactions where immunological mechanisms of action have not been proven, e.g., repeated low-level irritation, pharmacologically mediated effects;

(iv) A chemical structure related to substances known to cause respiratory hypersensitivity;

(b) Data from positive bronchial challenge tests with the substance conducted according to accepted guidelines for the determination of a specific hypersensitivity reaction.

A.4.2.1.2.4 Clinical history should include both medical and occupational history to determine a relationship between exposure to a specific substance and development of respiratory hypersensitivity. Relevant information includes aggravating factors both in the home and workplace, the onset and progress of the disease, family history and medical history of the patient in question. The medical history should also include a note of other allergic or airway disorders from childhood and smoking history.

A.4.2.1.2.5 The results of positive bronchial challenge tests are considered to provide sufficient evidence for classification on their own. It is, however, recognized that in practice many of the examinations listed above will already have been carried out.

A.4.2.1.3 Animal studies.

A.4.2.1.3.1 Data from appropriate animal studies [2] which may be indicative of the potential of a substance to cause sensitization by inhalation in humans [3] may include:

(a) Measurements of Immunoglobulin E (IgE) and other specific immunological parameters, for example in mice

(b) Specific pulmonary responses in guinea pigs.

A.4.2.2 Skin Sensitizers

A.4.2.2.1 Hazard categories.

A.4.2.2.1.1 Effects seen in either humans or animals will normally justify classification in a weight of evidence approach for skin sensitizers. Substances may be allocated to one of the two sub-categories 1A or 1B using a weight of evidence approach in accordance with the criteria given in Table A.4.2 and on the basis of reliable and good quality evidence from human cases or epidemiological studies and/or observations from appropriate studies in experimental animals according to the guidance values provided in A.4.2.2.2.1 and A.4.2.2.3.2 for sub-category 1A and in A.4.2.2.2.2 and A.4.2.2.3.3 for sub-category 1B.

A.4.2.2.1.2 Where data are not sufficient for sub-categorization, skin sensitizers shall be classified in Category 1.

TABLE A.4.2—HAZARD CATEGORY AND SUB-CATEGORIES FOR SKIN SENSITIZERS

Category 1	Skin sensitizer
	A substance is classified as a skin sensitizer. (a) if there is evidence in humans that the substance can lead to sensitization by skin contact in a substantial number of persons, or (b) if there are positive results from an appropriate animal test.
Sub-category 1A	Substances showing a high frequency of occurrence in humans and/or a high potency in animals can be presumed to have the potential to produce significant sensitization in humans. Severity of reaction may also be considered.
Sub-category 1B	Substances showing a low to moderate frequency of occurrence in humans and/or a low to moderate potency in animals can be presumed to have the potential to produce sensitization in humans. Severity of reaction may also be considered.

A.4.2.2.2 Human evidence.

A.4.2.2.2.1 Human evidence for sub-category 1A may include:

(a) Positive responses at ≤500 μg/cm² (Human Repeat Insult Patch Test (HRIPT), Human Maximization Test (HMT)—induction threshold);

(b) Diagnostic patch test data where there is a relatively high and substantial incidence of reactions in a defined population in relation to relatively low exposure;

(c) Other epidemiological evidence where there is a relatively high and substantial incidence of allergic contact dermatitis in relation to relatively low exposure.

A.4.2.2.2.2 Human evidence for sub-category 1B may include:

(a) Positive responses at >500 μg/cm² (HRIPT, HMT—induction threshold);

(b) Diagnostic patch test data where there is a relatively low but substantial incidence of reactions in a defined population in relation to relatively high exposure;

(c) Other epidemiological evidence where there is a relatively low but substantial incidence of allergic contact dermatitis in relation to relatively high exposure.

A.4.2.2.3 Animal studies

A.4.2.2.3.1 For Category 1, when an adjuvant type test method for skin sensitization is used, a response of at least 30% of the animals is considered as positive. For a non-adjuvant Guinea pig test method a response of at least 15% of the animals is considered positive. For Category 1, a stimulation index of three or more is considered a positive response in the local lymph node assay.[4]

A.4.2.2.3.2 Animal test results for sub-category 1A can include data with values indicated in Table A.4.3 below:

TABLE A.4.3—ANIMAL TEST RESULTS FOR SUB-CATEGORY 1A

Assay	Criteria
Local lymph node assay	EC3 value ≤2%.
Guinea pig maximization test	≥30% responding at ≤0.1% intradermal induction dose *or* ≥60% responding at >0.1% to ≤1% intradermal induction dose.
Buehler assay	≥15% responding at ≤0.2% topical induction dose *or*

[2] *At this writing, recognized and validated animal models for the testing of respiratory hypersensitivity are not available. Under certain circumstances, data from animal studies may provide valuable information in a weight of evidence assessment.*

[3] *The mechanisms by which substances induce symptoms of asthma are not yet fully known. For preventive measures, these substances are considered respiratory sensitizers. However, if on the basis of the evidence, it can be demonstrated that these substances induce symptoms of asthma by irritation only in people with bronchial hyperactivity, they should not be considered as respiratory sensitizers.*

[4] *Test methods for skin sensitization are described in OECD Guideline 406 (the Guinea Pig Maximization test and the Buehler guinea pig test) and Guideline 429 (Local Lymph Node Assay). Other methods may be used provided that they are scientifically validated. The Mouse Ear Swelling Test (MEST), appears to be a reliable screening test to detect moderate to strong sensitizers, and can be used, in accordance with professional judgment, as a first stage in the assessment of skin sensitization potential.*

TABLE A.4.3—ANIMAL TEST RESULTS FOR SUB-CATEGORY 1A—Continued

Assay	Criteria
	≥60% responding at >0.2% to ≤20% topical induction dose.

Note: *EC3 refers to the estimated concentration of test chemical required to induce a stimulation index of 3 in the local lymph node assay.*

A.4.2.2.3.3 Animal test results for sub-category 1B can include data with values indicated in Table A.4.4 below:

TABLE A.4.4—ANIMAL TEST RESULTS FOR SUB-CATEGORY 1B

Assay	Criteria
Local lymph node assay	EC3 value >2%.
Guinea pig maximization test	≥30% to <60% responding at >0.1% to ≤1% intradermal induction dose or ≥30% responding at >1% intradermal induction dose.
Buehler assay	≥15% to <60% responding at >0.2% to ≤20% topical induction dose or ≥15% responding at >20% topical induction dose.

Note: *EC3 refers to the estimated concentration of test chemical required to induce a stimulation index of 3 in the local lymph node assay.*

A.4.2.2.4 Specific considerations.

A.4.2.2.4.1 For classification of a substance, evidence shall include one or more of the following using a weight of evidence approach:

(a) Positive data from patch testing, normally obtained in more than one dermatology clinic;

(b) Epidemiological studies showing allergic contact dermatitis caused by the substance. Situations in which a high proportion of those exposed exhibit characteristic symptoms are to be looked at with special concern, even if the number of cases is small;

(c) Positive data from appropriate animal studies;

(d) Positive data from experimental studies in man (See paragraph A.0.2.6 of this Appendix);

(e) Well documented episodes of allergic contact dermatitis, normally obtained in more than one dermatology clinic;

(f) Severity of reaction.

A.4.2.2.4.2 Evidence from animal studies is usually much more reliable than evidence from human exposure. However, in cases where evidence is available from both sources, and there is conflict between the results, the quality and reliability of the evidence from both sources must be assessed in order to resolve the question of classification on a case-by-case basis. Normally, human data are not generated in controlled experiments with volunteers for the purpose of hazard classification but rather as part of risk assessment to confirm lack of effects seen in animal tests. Consequently, positive human data on skin sensitization are usually derived from case-control or other, less defined studies. Evaluation of human data must, therefore, be carried out with caution as the frequency of cases reflect, in addition to the inherent properties of the substances, factors such as the exposure situation, bioavailability, individual predisposition and preventive measures taken. Negative human data should not normally be used to negate positive results from animal studies. For both animal and human data, consideration should be given to the impact of vehicle.

A.4.2.2.4.3 If none of the above-mentioned conditions are met, the substance need not be classified as a skin sensitizer. However, a combination of two or more indicators of skin sensitization, as listed below, may alter the decision. This shall be considered on a case-by-case basis.

(a) Isolated episodes of allergic contact dermatitis;

(b) Epidemiological studies of limited power, e.g., where chance, bias or confounders have not been ruled out fully with reasonable confidence;

(c) Data from animal tests, performed according to existing guidelines, which do not meet the criteria for a positive result described in A.4.2.2.3, but which are sufficiently close to the limit to be considered significant;

(d) Positive data from non-standard methods;

(e) Positive results from close structural analogues.

A.4.2.2.4.4 Immunological contact urticaria.

A.4.2.2.4.4.1 Substances meeting the criteria for classification as respiratory sensitizers may, in addition, cause immunological contact urticaria. Consideration shall be given to classifying these substances as skin sensitizers.

A.4.2.2.4.4.2 Substances which cause immunological contact urticaria without meeting the criteria for respiratory sensitizers shall be considered for classification as skin sensitizers.

A.4.2.2.4.4.3 There is no recognized animal model available to identify substances which cause immunological contact urticaria. Therefore, classification will normally be based on human evidence, similar to that for skin sensitization.

A.4.3 Classification Criteria for Mixtures

A.4.3.1 Classification of Mixtures When Data Are Available for the Complete Mixture

When reliable and good quality evidence, as described in the criteria for substances, from human experience or appropriate studies in experimental animals, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of these data. Care must be exercised in evaluating data on mixtures that the dose used does not render the results inconclusive.

A.4.3.2 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.4.3.2.1 Where the mixture itself has not been tested to determine its sensitizing properties, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following agreed bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation, Substantially similar mixtures, and Aerosols.

A.4.3.3 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

The mixture shall be classified as a respiratory or skin sensitizer when at least one ingredient has been classified as a respiratory or skin sensitizer and is present at or above the appropriate cut-off value/concentration limit for the specific endpoint as shown in Table A.4.5.

TABLE A.4.5—CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS EITHER RESPIRATORY SENSITIZERS OR SKIN SENSITIZERS THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE

Ingredient classified as:	Cut-off values/concentration limits triggering classification of a mixture as:		
	Respiratory Sensitizer Category 1		Skin Sensitizer Category 1
	Solid/liquid	Gas	All physical states
Respiratory Sensitizer, Category 1	≥0.1%	≥0.1%	
Respiratory Sensitizer, Sub-category 1A	≥0.1%	≥0.1%	
Respiratory Sensitizer, Sub-category 1B	≥1.0%	≥0.2%	
Skin Sensitizer, Category 1			≥0.1%
Skin Sensitizer, Sub-category 1A			≥0.1%
Skin Sensitizer, Sub-category 1B			≥1.0%

A.5 GERM CELL MUTAGENICITY

A.5.1 Definitions and General Considerations

A.5.1.1 A *mutation* is defined as a permanent change in the amount or structure of the genetic material in a cell. The term *mutation* applies both to heritable genetic changes that may be manifested at the phenotypic level and to the underlying DNA modifications when known (including, for example, specific base pair changes and chromosomal translocations). The term *mutagenic* and *mutagen* will be used for agents giving rise to an increased occurrence of mutations in populations of cells and/or organisms.

A.5.1.2 The more general terms *genotoxic* and *genotoxicity* apply to agents or processes which alter the structure, information content, or segregation of DNA, including those which cause DNA damage by interfering with normal replication processes, or which in a non-physiological manner (temporarily) alter its replication. Genotoxicity test results are usually taken as indicators for mutagenic effects.

A.5.1.3 This hazard class is primarily concerned with chemicals that may cause mutations in the germ cells of humans that can be transmitted to the progeny. However, mutagenicity/genotoxicity tests *in vitro* and in mammalian somatic cells *in vivo* are also considered in classifying substances and mixtures within this hazard class.

A.5.2 Classification Criteria for Substances

A.5.2.1 The classification system provides for two different categories of germ cell mutagens to accommodate the weight of evidence available. The two-category system is described in the Figure A.5.1.

FIGURE A.5.1—HAZARD CATEGORIES FOR GERM CELL MUTAGENS

CATEGORY 1: Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans.

Category 1A: Substances known to induce heritable mutations in germ cells of humans.

Positive evidence from human epidemiological studies.

Category 1B: Substances which should be regarded as if they induce heritable mutations in the germ cells of humans.

(a) Positive result(s) from *in vivo* heritable germ cell mutagenicity tests in mammals; or

(b) Positive result(s) from *in vivo* somatic cell mutagenicity tests in mammals, in combination with some evidence that the substance has potential to cause mutations to germ cells. This supporting evidence may, for example, be derived from mutagenicity/genotoxicity tests in germ cells *in vivo*, or by demonstrating the ability of the substance or its metabolite(s) to interact with the genetic material of germ cells; or

(c) Positive results from tests showing mutagenic effects in the germ cells of humans, without demonstration of transmission to progeny; for example, an increase in the frequency of aneuploidy in sperm cells of exposed people.

CATEGORY 2: Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans.

Positive evidence obtained from experiments in mammals and/or in some cases from *in vitro* experiments, obtained from:

(a) Somatic cell mutagenicity tests *in vivo*, in mammals; or

(b) Other *in vivo* somatic cell genotoxicity tests which are supported by positive results from *in vitro* mutagenicity assays.

Note: *Substances which are positive in in vitro mammalian mutagenicity assays, and which also show chemical structure activity relationship to known germ cell mutagens, should be considered for classification as Category 2 mutagens.*

A.5.2.2 Specific considerations for classification of substances as germ cell mutagens:

A.5.2.2.1 To arrive at a classification, test results are considered from experiments determining mutagenic and/or genotoxic effects in germ and/or somatic cells of exposed animals. Mutagenic and/or genotoxic effects determined in *in vitro* tests shall also be considered.

A.5.2.2.2 The system is hazard based, classifying chemicals on the basis of their intrinsic ability to induce mutations in germ cells. The scheme is, therefore, not meant for the (quantitative) risk assessment of chemical substances.

A.5.2.2.3 Classification for heritable effects in human germ cells is made on the basis of scientifically validated tests. Evaluation of the test results shall be done using expert judgment and all the available evidence shall be weighed for classification.

A.5.2.2.4 The classification of substances shall be based on the total weight of evidence available, using expert judgment. In those instances where a single well-conducted test is used for classification, it shall provide clear and unambiguously positive results. The relevance of the route of exposure used in the study of the substance compared to the route of human exposure should also be taken into account.

A.5.3 Classification Criteria for Mixtures [5]

A.5.3.1 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.5.3.1.1 Classification of mixtures shall be based on the available test data for the

[5] *It should be noted that the classification criteria for health hazards usually include a tiered scheme in which test data available on the complete mixture are considered as the first tier in the evaluation, followed by the applicable bridging principles, and lastly, cut-off values/concentration limits or additivity. However, this approach is not used for Germ Cell Mutagenicity. These criteria for Germ Cell Mutagenicity consider the cut-off values/concentration limits as the primary tier and allow*

Continued

individual ingredients of the mixture using cut-off values/concentration limits for the ingredients classified as germ cell mutagens.

A.5.3.1.2 The mixture will be classified as a mutagen when at least one ingredient has been classified as a Category 1A, Category 1B or Category 2 mutagen and is present at or above the appropriate cut-off value/concentration limit as shown in Table A.5.1 below for Category 1 and 2 respectively.

TABLE A.5.1—CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS GERM CELL MUTAGENS THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE

Ingredient classified as:	Cut-off/concentration limits triggering classification of a mixture as:	
	Category 1 mutagen	Category 2 mutagen
Category 1A/B mutagen	≥0.1%	
Category 2 mutagen		≥1.0%

Note: *The cut-off values/concentration limits in the table above apply to solids and liquids (w/w units) as well as gases (v/v units).*

A.5.3.2 Classification of Mixtures When Data Are Available for the Mixture Itself

The classification may be modified on a case-by-case basis based on the available test data for the mixture as a whole. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g. statistical analysis, test sensitivity) of germ cell mutagenicity test systems.

A.5.3.3 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.5.3.3.1 Where the mixture itself has not been tested to determine its germ cell mutagenicity hazard, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, and Substantially similar mixtures.

A.5.4 Examples of Scientifically Validated Test Methods

A.5.4.1 Examples of *in vivo* heritable germ cell mutagenicity tests are:
(a) Rodent dominant lethal mutation test (OECD 478)
(b) Mouse heritable translocation assay (OECD 485)
(c) Mouse specific locus test

A.5.4.2 Examples of *in vivo* somatic cell mutagenicity tests are:
(a) Mammalian bone marrow chromosome aberration test (OECD 475)
(b) Mouse spot test (OECD 484)
(c) Mammalian erythrocyte micronucleus test (OECD 474)

A.5.4.3 Examples of mutagenicity/genotoxicity tests in germ cells are:
(a) Mutagenicity tests:
(i) Mammalian spermatogonial chromosome aberration test (OECD 483)
(ii) Spermatid micronucleus assay
(b) Genotoxicity tests:
(i) Sister chromatid exchange analysis in spermatogonia
(ii) Unscheduled DNA synthesis test (UDS) in testicular cells

A.5.4.4 Examples of genotoxicity tests in somatic cells are:
(a) Liver Unscheduled DNA Synthesis (UDS) *in vivo* (OECD 486)
(b) Mammalian bone marrow Sister Chromatid Exchanges (SCE)

A.5.4.5 Examples of *in vitro* mutagenicity tests are:
(a) *In vitro* mammalian chromosome aberration test (OECD 473)
(b) *In vitro* mammalian cell gene mutation test (OECD 476)
(c) Bacterial reverse mutation tests (OECD 471)

A.5.4.6 As new, scientifically validated tests arise, these may also be used in the total weight of evidence to be considered.

A.6 CARCINOGENICITY

A.6.1 Definitions

Carcinogen means a substance or a mixture of substances which induce cancer or increase its incidence. Substances and mixtures which have induced benign and malignant tumors in well-performed experimental studies on animals are considered also to be presumed or suspected human carcinogens unless there is strong evidence that the mechanism of tumor formation is not relevant for humans.

Classification of a substance or mixture as posing a carcinogenic hazard is based on its inherent properties and does not provide information on the level of the human cancer risk which the use of the substance or mixture may represent.

A.6.2 Classification Criteria for Substances[6]

A.6.2.1 For the purpose of classification for carcinogenicity, substances are allocated to one of two categories based on strength of evidence and additional weight of evidence considerations. In certain instances, route-specific classification may be warranted.

FIGURE A.6.1—HAZARD CATEGORIES FOR CARCINOGENS

CATEGORY 1: Known or presumed human carcinogens.

The classification of a substance as a Category 1 carcinogen is done on the basis of epidemiological and/or animal data. This classification is further distinguished on the basis of whether the evidence for classification is largely from human data (Category 1A) or from animal data (Category 1B):

Category 1A: Known to have carcinogenic potential for humans. Classification in this category is largely based on human evidence.

Category 1B: Presumed to have carcinogenic potential for humans. Classification in this category is largely based on animal evidence.

The classification of a substance in Category 1A and 1B is based on strength of evidence together with weight of evidence considerations (See paragraph A.6.2.5). Such evidence may be derived from:

—human studies that establish a causal relationship between human exposure to a substance and the development of cancer (known human carcinogen); or

—animal experiments for which there is sufficient evidence to demonstrate animal carcinogenicity (presumed human carcinogen).

In addition, on a case by case basis, scientific judgment may warrant a decision of presumed human carcinogenicity derived from studies showing limited evidence of carcinogenicity in humans together with limited evidence of carcinogenicity in experimental animals.

CATEGORY 2: Suspected human carcinogens.

the classification to be modified only on a case-by-case evaluation based on available test data for the mixture as a whole.

[6] *See Non-mandatory Appendix F Part A for further guidance regarding hazard classification for carcinogenicity. This appendix is consistent with the GHS adn is provided as guidance excerpted from the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006).*

FIGURE A.6.1—HAZARD CATEGORIES FOR CARCINOGENS—Continued

The classification of a substance in Category 2 is done on the basis of evidence obtained from human and/or animal studies, but which is not sufficiently convincing to place the substance in Category 1A or B. This classification is based on strength of evidence together with weight of evidence considerations (See paragraph A.6.2.5). Such evidence may be from either limited evidence of carcinogenicity in human studies or from limited evidence of carcinogenicity in animal studies.
Other considerations: Where the weight of evidence for the carcinogenicity of a substance does not meet the above criteria, any positive study conducted in accordance with established scientific principles, and which reports statistically significant findings regarding the carcinogenic potential of the substance, must be noted on the safety data sheet.

A.6.2.2 Classification as a carcinogen is made on the basis of evidence from reliable and acceptable methods, and is intended to be used for substances which have an intrinsic property to produce such toxic effects. The evaluations are to be based on all existing data, peer-reviewed published studies and additional data accepted by regulatory agencies.

A.6.2.3 *Carcinogen classification* is a one-step, criterion-based process that involves two interrelated determinations: evaluations of strength of evidence and consideration of all other relevant information to place substances with human cancer potential into hazard categories.

A.6.2.4 *Strength of evidence* involves the enumeration of tumors in human and animal studies and determination of their level of statistical significance. Sufficient human evidence demonstrates causality between human exposure and the development of cancer, whereas sufficient evidence in animals shows a causal relationship between the agent and an increased incidence of tumors. Limited evidence in humans is demonstrated by a positive association between exposure and cancer, but a causal relationship cannot be stated. Limited evidence in animals is provided when data suggest a carcinogenic effect, but are less than sufficient. (Guidance on consideration of important factors in the classification of carcinogenicity and a more detailed description of the terms "limited" and "sufficient" have been developed by the International Agency for Research on Cancer (IARC) and are provided in non-mandatory Appendix F).

A.6.2.5 *Weight of evidence:* Beyond the determination of the strength of evidence for carcinogenicity, a number of other factors should be considered that influence the overall likelihood that an agent may pose a carcinogenic hazard in humans. The full list of factors that influence this determination is very lengthy, but some of the important ones are considered here.

A.6.2.5.1 These factors can be viewed as either increasing or decreasing the level of concern for human carcinogenicity. The relative emphasis accorded to each factor depends upon the amount and coherence of evidence bearing on each. Generally there is a requirement for more complete information to decrease than to increase the level of concern. Additional considerations should be used in evaluating the tumor findings and the other factors in a case-by-case manner.

A.6.2.5.2 Some important factors which may be taken into consideration, when assessing the overall level of concern are:

(a) Tumor type and background incidence;

(b) Multisite responses;

(c) Progression of lesions to malignancy;

(d) Reduced tumor latency;

Additional factors which may increase or decrease the level of concern include:

(e) Whether responses are in single or both sexes;

(f) Whether responses are in a single species or several species;

(g) Structural similarity or not to a substance(s) for which there is good evidence of carcinogenicity;

(h) Routes of exposure;

(i) Comparison of absorption, distribution, metabolism and excretion between test animals and humans;

(j) The possibility of a confounding effect of excessive toxicity at test doses; and,

(k) Mode of action and its relevance for humans, such as mutagenicity, cytotoxicity with growth stimulation, mitogenesis, immunosuppression.

Mutagenicity: It is recognized that genetic events are central in the overall process of cancer development. Therefore evidence of mutagenic activity *in vivo* may indicate that a substance has a potential for carcinogenic effects.

A.6.2.5.3 A substance that has not been tested for carcinogenicity may in certain instances be classified in Category 1A, Category 1B, or Category 2 based on tumor data from a structural analogue together with substantial support from consideration of other important factors such as formation of common significant metabolites, e.g., for benzidine congener dyes.

A.6.2.5.4 The classification should also take into consideration whether or not the substance is absorbed by a given route(s); or whether there are only local tumors at the site of administration for the tested route(s), and adequate testing by other major route(s) show lack of carcinogenicity.

A.6.2.5.5 It is important that whatever is known of the physico-chemical, toxicokinetic and toxicodynamic properties of the substances, as well as any available relevant information on chemical analogues, i.e., structure activity relationship, is taken into consideration when undertaking classification.

A.6.3 Classification Criteria for Mixtures[7]

A.6.3.1 The mixture shall be classified as a carcinogen when at least one ingredient has been classified as a Category 1 or Category 2 carcinogen and is present at or above the appropriate cut-off value/concentration limit as shown in Table A.6.1.

TABLE A.6.1—CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS CARCINOGEN THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE

Ingredient classified as:	Category 1 carcinogen	Category 2 carcinogen
Category 1 carcinogen	≥0.1%	
Category 2 carcinogen		≥0.1% (note 1).

Note: *If a Category 2 carcinogen ingredient is present in the mixture at a concentration between 0.1% and 1%, information is required on the SDS for a product. However, a label warning is optional. If a Category 2 carcinogen ingredient is present in the mixture at a concentration of ≥1%, both an SDS and a label is required and the information must be included on each.*

[7] *It should be noted that the classification criteria for health hazards usually include a tiered scheme in which test data available on the complete mixture are considered as the first tier in the evaluation, followed by the applicable bridging principles, and lastly, cut-off values/concentration limit or additivity. However, this approach is not used for Carcinogenicity. These criteria for Carcinogenicity consider the cut-off values/concentration limits as the primary tier and allow the classification to be modified only on a case-by-case evaluation based on available test data for the mixture as a whole.*

A.6.3.2 Classification of Mixtures When Data Are Available for the Complete Mixture

A mixture may be classified based on the available test data for the mixture as a whole. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g., statistical analysis, test sensitivity) of carcinogenicity test systems.

A.6.3.3 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

Where the mixture itself has not been tested to determine its carcinogenic hazard, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data will be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; and Substantially similar mixtures.

A.6.4 Classification of Carcinogenicity [8]

A.6.4.1 Chemical manufacturers, importers and employers evaluating chemicals may treat the following sources as establishing that a substance is a carcinogen or potential carcinogen for hazard communication purposes in lieu of applying the criteria described herein:

A.6.4.1.1 National Toxicology Program (NTP), "Report on Carcinogens" (latest edition);

A.6.4.1.2 International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (latest editions)

A.6.4.2 Where OSHA has included cancer as a health hazard to be considered by classifiers for a chemical covered by 29 CFR part 1910, Subpart Z, Toxic and Hazardous Substances, chemical manufacturers, importers, and employers shall classify the chemical as a carcinogen.

A.7 REPRODUCTIVE TOXICITY

A.7.1 Definitions and General Considerations

A.7.1.1 *Reproductive toxicity* includes *adverse effects on sexual function and fertility* in adult males and females, as well as *adverse effects on development of the offspring*. Some reproductive toxic effects cannot be clearly assigned to either impairment of sexual function and fertility or to developmental toxicity. Nonetheless, chemicals with these effects shall be classified as reproductive toxicants.

For classification purposes, the known induction of genetically based inheritable effects in the offspring is addressed in *Germ cell mutagenicity* (See A.5).

A.7.1.2 *Adverse effects on sexual function and fertility* means any effect of chemicals that interferes with reproductive ability or sexual capacity. This includes, but is not limited to, alterations to the female and male reproductive system, adverse effects on onset of puberty, gamete production and transport, reproductive cycle normality, sexual behaviour, fertility, parturition, pregnancy outcomes, premature reproductive senescence, or modifications in other functions that are dependent on the integrity of the reproductive systems.

A.7.1.3 *Adverse effects on development of the offspring* means any effect of chemicals which interferes with normal development of the conceptus either before or after birth, which is induced during pregnancy or results from parental exposure. These effects can be manifested at any point in the life span of the organism. The major manifestations of developmental toxicity include death of the developing organism, structural abnormality, altered growth and functional deficiency.

A.7.1.4 Adverse effects on or via lactation are also included in reproductive toxicity, but for classification purposes, such effects are treated separately (See A.7.2.1).

A.7.2 Classification Criteria for Substances

A.7.2.1 For the purpose of classification for reproductive toxicity, substances shall be classified in one of two categories in accordance with Figure A.7.1(a). Effects on sexual function and fertility, and on development, shall be considered. In addition, effects on or via lactation shall be classified in a separate hazard category in accordance with Figure A.7.1(b).

FIGURE A.7.1(a)—HAZARD CATEGORIES FOR REPRODUCTIVE TOXICANTS

CATEGORY 1: Known or presumed human reproductive toxicant.

Substance shall be classified in Category 1 for reproductive toxicity when they are known to have produced an adverse effect on sexual function and fertility or on development in humans or when there is evidence from animal studies, possibly supplemented with other information, to provide a strong presumption that the substance has the capacity to interfere with reproduction in humans. The classification of a substance is further distinguished on the basis of whether the evidence for classification is primarily from human data (Category 1A) or from animal data (Category 1B).

Category 1A: Known human reproductive toxicant.

The classification of a substance in this category is largely based on evidence from humans.

Category 1B: Presumed human reproductive toxicant.

The classification of a substance in this category is largely based on evidence from experimental animals. Data from animal studies shall provide sufficient evidence of an adverse effect on sexual function and fertility or on development in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is considered not to be a secondary non-specific consequence of other toxic effects. However, when there is mechanistic information that raises doubt about the relevance of the effect for humans, classification in Category 2 may be more appropriate.

CATEGORY 2: Suspected human reproductive toxicant.

Substances shall be classified in Category 2 for reproductive toxicity when there is some evidence from humans or experimental animals, possibly supplemented with other information, of an adverse effect on sexual function and fertility, or on development, in the absence of other toxic effects, or if occurring together with other toxic effects the adverse effect on reproduction is considered not to be a secondary non-specific consequence of the other toxic effects, and where the evidence is not sufficiently convincing to place the substance in Category 1. For instance, deficiencies in the study may make the quality of evidence less convincing, and in view of this, Category 2 would be the more appropriate classification.

FIGURE A.7.1(b)—HAZARD CATEGORY FOR EFFECTS ON OR VIA LACTATION

EFFECTS ON OR VIA LACTATION

Effects on or via lactation shall be classified in a separate single category. Chemicals that are absorbed by women and have been shown to interfere with lactation or that may be present (including metabolites) in breast milk in amounts sufficient to cause concern for the health of a breastfed child, shall be classified to indicate this property hazardous to breastfed babies. This classification shall be assigned on the basis of:

(a) absorption, metabolism, distribution and excretion studies that indicate the likelihood the substance would be present in potentially toxic levels in breast milk; and/or

[8] *See Non-mandatory Appendix F for further guidance regarding hazard classification for carcinogenicity and how to relate carcinogenicity classification information from IARC and NTP to GHS.*

FIGURE A.7.1(b)—HAZARD CATEGORY FOR EFFECTS ON OR VIA LACTATION—Continued

(b) results of one or two generation studies in animals which provide clear evidence of adverse effect in the offspring due to transfer in the milk or adverse effect on the quality of the milk; and/or (c) human evidence indicating a hazard to babies during the lactation period.

A.7.2.2 Basis of Classification

A.7.2.2.1 Classification is made on the basis of the criteria, outlined above, an assessment of the total weight of evidence, and the use of expert judgment. Classification as a reproductive toxicant is intended to be used for substances which have an intrinsic, specific property to produce an adverse effect on reproduction and substances should not be so classified if such an effect is produced solely as a non-specific secondary consequence of other toxic effects.

A.7.2.2.2 In the evaluation of toxic effects on the developing offspring, it is important to consider the possible influence of maternal toxicity.

A.7.2.2.3 For human evidence to provide the primary basis for a Category 1A classification there must be reliable evidence of an adverse effect on reproduction in humans. Evidence used for classification shall be from well conducted epidemiological studies, if available, which include the use of appropriate controls, balanced assessment, and due consideration of bias or confounding factors. Less rigorous data from studies in humans may be sufficient for a Category 1A classification if supplemented with adequate data from studies in experimental animals, but classification in Category 1B may also be considered.

A.7.2.3 Weight of Evidence

A.7.2.3.1 Classification as a reproductive toxicant is made on the basis of an assessment of the total weight of evidence using expert judgment. This means that all available information that bears on the determination of reproductive toxicity is considered together. Included is information such as epidemiological studies and case reports in humans and specific reproduction studies along with sub-chronic, chronic and special study results in animals that provide relevant information regarding toxicity to reproductive and related endocrine organs. Evaluation of substances chemically related to the material under study may also be included, particularly when information on the material is scarce. The weight given to the available evidence will be influenced by factors such as the quality of the studies, consistency of results, nature and severity of effects, level of statistical significance for intergroup differences, number of endpoints affected, relevance of route of administration to humans and freedom from bias. Both positive and negative results are considered together in a weight of evidence determination. However, a single, positive study performed according to good scientific principles and with statistically or biologically significant positive results may justify classification (See also A.7.2.2.3).

A.7.2.3.2 Toxicokinetic studies in animals and humans, site of action and mechanism or mode of action study results may provide relevant information, which could reduce or increase concerns about the hazard to human health. If it is conclusively demonstrated that the clearly identified mechanism or mode of action has no relevance for humans or when the toxicokinetic differences are so marked that it is certain that the hazardous property will not be expressed in humans then a chemical which produces an adverse effect on reproduction in experimental animals should not be classified.

A.7.2.3.3 In some reproductive toxicity studies in experimental animals the only effects recorded may be considered of low or minimal toxicological significance and classification may not necessarily be the outcome. These effects include, for example, small changes in semen parameters or in the incidence of spontaneous defects in the fetus, small changes in the proportions of common fetal variants such as are observed in skeletal examinations, or in fetal weights, or small differences in postnatal developmental assessments.

A.7.2.3.4 Data from animal studies shall provide sufficient evidence of specific reproductive toxicity in the absence of other systemic toxic effects. However, if developmental toxicity occurs together with other toxic effects in the dam (mother), the potential influence of the generalized adverse effects should be assessed to the extent possible. The preferred approach is to consider adverse effects in the embryo/fetus first, and then evaluate maternal toxicity, along with any other factors which are likely to have influenced these effects, as part of the weight of evidence. In general, developmental effects that are observed at maternally toxic doses should not be automatically discounted. Discounting developmental effects that are observed at maternally toxic doses can only be done on a case-by-case basis when a causal relationship is established or refuted.

A.7.2.3.5 If appropriate information is available it is important to try to determine whether developmental toxicity is due to a specific maternally mediated mechanism or to a non-specific secondary mechanism, like maternal stress and the disruption of homeostasis. Generally, the presence of maternal toxicity should not be used to negate findings of embryo/fetal effects, unless it can be clearly demonstrated that the effects are secondary non-specific effects. This is especially the case when the effects in the offspring are significant, e.g., irreversible effects such as structural malformations. In some situations it is reasonable to assume that reproductive toxicity is due to a secondary consequence of maternal toxicity and discount the effects, for example if the chemical is so toxic that dams fail to thrive and there is severe inanition; they are incapable of nursing pups; or they are prostrate or dying.

A.7.2.4 Maternal Toxicity

A.7.2.4.1 Development of the offspring throughout gestation and during the early postnatal stages can be influenced by toxic effects in the mother either through non-specific mechanisms related to stress and the disruption of maternal homeostasis, or by specific maternally-mediated mechanisms. So, in the interpretation of the developmental outcome to decide classification for developmental effects it is important to consider the possible influence of maternal toxicity. This is a complex issue because of uncertainties surrounding the relationship between maternal toxicity and developmental outcome. Expert judgment and a weight of evidence approach, using all available studies, shall be used to determine the degree of influence to be attributed to maternal toxicity when interpreting the criteria for classification for developmental effects. The adverse effects in the embryo/fetus shall be first considered, and then maternal toxicity, along with any other factors which are likely to have influenced these effects, as weight of evidence, to help reach a conclusion about classification.

A.7.2.4.2 Based on pragmatic observation, it is believed that maternal toxicity may, depending on severity, influence development via non-specific secondary mechanisms, producing effects such as depressed fetal weight, retarded ossification, and possibly resorptions and certain malformations in some strains of certain species. However, the limited numbers of studies which have investigated the relationship between developmental effects and general maternal toxicity have failed to demonstrate a consistent, reproducible relationship across species. Developmental effects which occur even in the presence of maternal toxicity are considered to be evidence of developmental toxicity, unless it can be unequivocally demonstrated on a case by case basis that the developmental effects are secondary to maternal toxicity. Moreover, classification shall be considered where there is a significant toxic effect in the offspring, e.g., irreversible effects such as structural malformations, embryo/fetal lethality, or significant post-natal functional deficiencies.

A.7.2.4.3 Classification shall not automatically be discounted for chemicals that produce developmental toxicity only in association with maternal toxicity, even if a specific maternally-mediated mechanism has been demonstrated. In such a case, classification in Category 2 may be considered more appropriate than Category 1. However, when a chemical is so toxic that maternal death or severe inanition results, or the dams (mothers) are prostrate and incapable of nursing the pups, it is reasonable to assume that developmental toxicity is produced solely as a secondary consequence of maternal toxicity and discount the developmental effects.

Classification is not necessarily the outcome in the case of minor developmental changes, e.g., a small reduction in fetal/pup body weight or retardation of ossification when seen in association with maternal toxicity.

A.7.2.4.4 Some of the endpoints used to assess maternal toxicity are provided below. Data on these endpoints, if available, shall be evaluated in light of their statistical or biological significance and dose-response relationship.

(a) Maternal mortality: An increased incidence of mortality among the treated dams over the controls shall be considered evidence of maternal toxicity if the increase occurs in a dose-related manner and can be attributed to the systemic toxicity of the test material. Maternal mortality greater than 10% is considered excessive and the data for that dose level shall not normally be considered to need further evaluation.

(b) Mating index (Number of animals with seminal plugs or sperm/Number of mated × 100)

(c) Fertility index (Number of animals with implants/Number of matings × 100)

(d) Gestation length (If allowed to deliver)

(e) Body weight and body weight change: Consideration of the maternal body weight change and/or adjusted (corrected) maternal body weight shall be included in the evaluation of maternal toxicity whenever such data are available. The calculation of an adjusted (corrected) mean maternal body weight change, which is the difference between the initial and terminal body weight minus the gravid uterine weight (or alternatively, the sum of the weights of the fetuses), may indicate whether the effect is maternal or intrauterine. In rabbits, the body weight gain may not be a useful indicator of maternal toxicity because of normal fluctuations in body weight during pregnancy.

(f) Food and water consumption (if relevant): The observation of a significant decrease in the average food or water consumption in treated dams (mothers) compared to the control group may be useful in evaluating maternal toxicity, particularly when the test material is administered in the diet or drinking water. Changes in food or water consumption must be evaluated in conjunction with maternal body weights when determining if the effects noted are reflective of maternal toxicity or more simply, unpalatability of the test material in feed or water.

(g) Clinical evaluations (including clinical signs, markers, and hematology and clinical chemistry studies): The observation of increased incidence of significant clinical signs of toxicity in treated dams (mothers) relative to the control group is useful in evaluating maternal toxicity. If this is to be used as the basis for the assessment of maternal toxicity, the types, incidence, degree and duration of clinical signs shall be reported in the study. Clinical signs of maternal intoxication include, but are not limited to: coma, prostration, hyperactivity, loss of righting reflex, ataxia, or labored breathing.

(h) Post-mortem data: Increased incidence and/or severity of post-mortem findings may be indicative of maternal toxicity. This can include gross or microscopic pathological findings or organ weight data, including absolute organ weight, organ-to-body weight ratio, or organ-to-brain weight ratio. When supported by findings of adverse histopathological effects in the affected organ(s), the observation of a significant change in the average weight of suspected target organ(s) of treated dams (mothers), compared to those in the control group, may be considered evidence of maternal toxicity.

A.7.2.5 Animal and Experimental Data

A.7.2.5.1 A number of scientifically validated test methods are available, including methods for developmental toxicity testing (e.g., OECD Test Guideline 414, ICH Guideline S5A, 1993), methods for peri- and post-natal toxicity testing (e.g., ICH S5B, 1995), and methods for one or two-generation toxicity testing (e.g., OECD Test Guidelines 415, 416)

A.7.2.5.2 Results obtained from screening tests (e.g., OECD Guidelines 421—Reproduction/Developmental Toxicity Screening Test, and 422—Combined Repeated Dose Toxicity Study with Reproduction/Development Toxicity Screening Test) can also be used to justify classification, although the quality of this evidence is less reliable than that obtained through full studies.

A.7.2.5.3 Adverse effects or changes, seen in short- or long-term repeated dose toxicity studies, which are judged likely to impair reproductive function and which occur in the absence of significant generalized toxicity, may be used as a basis for classification, e.g., histopathological changes in the gonads.

A.7.2.5.4 Evidence from *in vitro* assays, or non-mammalian tests, and from analogous substances using structure-activity relationship (SAR), can contribute to the procedure for classification. In all cases of this nature, expert judgment must be used to assess the adequacy of the data. Inadequate data shall not be used as a primary support for classification.

A.7.2.5.5 It is preferable that animal studies are conducted using appropriate routes of administration which relate to the potential route of human exposure. However, in practice, reproductive toxicity studies are commonly conducted using the oral route, and such studies will normally be suitable for evaluating the hazardous properties of the substance with respect to reproductive toxicity. However, if it can be conclusively demonstrated that the clearly identified mechanism or mode of action has no relevance for humans or when the toxicokinetic differences are so marked that it is certain that the hazardous property will not be expressed in humans then a substance which produces an adverse effect on reproduction in experimental animals should not be classified.

A.7.2.5.6 Studies involving routes of administration such as intravenous or intraperitoneal injection, which may result in exposure of the reproductive organs to unrealistically high levels of the test substance, or elicit local damage to the reproductive organs, e.g., by irritation, must be interpreted with extreme caution and on their own are not normally the basis for classification.

A.7.2.5.7 There is general agreement about the concept of a limit dose, above which the production of an adverse effect may be considered to be outside the criteria which lead to classification. Some test guidelines specify a limit dose, other test guidelines qualify the limit dose with a statement that higher doses may be necessary if anticipated human exposure is sufficiently high that an adequate margin of exposure would not be achieved. Also, due to species differences in toxicokinetics, establishing a specific limit dose may not be adequate for situations where humans are more sensitive than the animal model.

A.7.2.5.8 In principle, adverse effects on reproduction seen only at very high dose levels in animal studies (for example doses that induce prostration, severe inappetence, excessive mortality) do not normally lead to classification, unless other information is available, for example, toxicokinetics information indicating that humans may be more susceptible than animals, to suggest that classification is appropriate.

A.7.2.5.9 However, specification of the actual "limit dose" will depend upon the test method that has been employed to provide the test results.

A.7.3 Classification Criteria for Mixtures[9]

A.7.3.1 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.7.3.1.1 The mixture shall be classified as a reproductive toxicant when at least one ingredient has been classified as a Category 1 or Category 2 reproductive toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.7.1 for Category 1 and 2, respectively.

A.7.3.1.2 The mixture shall be classified for effects on or via lactation when at least one ingredient has been classified for effects on or via lactation and is present at or above the appropriate cut-off value/concentration limit specified in Table A.7.1 for the additional category for effects on or via lactation.

[9] *It should be noted that the classification criteria for health hazards usually include a tiered scheme in which test data available on the complete mixture are considered as the first tier in the evaluation, followed by the applicable bridging principles, and lastly, cut-off values/concentration limits or additivity. However, this approach is not used for Reproductive Toxicity. These criteria for Reproductive Toxicity consider the cut-off values/concentration limits as the primary tier and allow the classification to be modified only on a case-by-case evaluation based on available test data for the mixture as a whole.*

TABLE A.7.1—CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS REPRODUCTIVE TOXICANTS OR FOR EFFECTS ON OR VIA LACTATION THAT TRIGGER CLASSIFICATION OF THE MIXTURE

Ingredients classified as:	Cut-off values/concentration limits triggering classification of a mixture as:		
	Category 1 reproductive toxicant	Category 2 reproductive toxicant	Additional category for effects on or via lactation
Category 1 reproductive toxicant	≥0.1%		
Category 2 reproductive toxicant		≥0.1%	
Additional category for effects on or via lactation			≥0.1%

A.7.3.2 Classification of Mixtures When Data Are Available for the Complete Mixture

Available test data for the mixture as a whole may be used for classification on a case-by-case basis. In such cases, the test results for the mixture as a whole must be shown to be conclusive taking into account dose and other factors such as duration, observations and analysis (e.g., statistical analysis, test sensitivity) of reproduction test systems.

A.7.3.3 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.7.3.3.1 Where the mixture itself has not been tested to determine its reproductive toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, and Substantially similar mixtures.

A.8 SPECIFIC TARGET ORGAN TOXICITY SINGLE EXPOSURE

A.8.1 Definitions and General Considerations

A.8.1.1 *Specific target organ toxicity—single exposure, (STOT–SE)* means specific, non-lethal target organ toxicity arising from a single exposure to a chemical. All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed and not specifically addressed in A.1 to A.7 and A.10 of this Appendix are included. Specific target organ toxicity following repeated exposure is classified in accordance with *SPECIFIC TARGET ORGAN TOXICITY—REPEATED EXPOSURE* (A.9 of this Appendix) and is therefore not included here.

A.8.1.2 Classification identifies the chemical as being a specific target organ toxicant and, as such, it presents a potential for adverse health effects in people who are exposed to it.

A.8.1.3 The adverse health effects produced by a single exposure include consistent and identifiable toxic effects in humans; or, in experimental animals, toxicologically significant changes which have affected the function or morphology of a tissue/organ, or have produced serious changes to the biochemistry or hematology of the organism, and these changes are relevant for human health. Human data is the primary source of evidence for this hazard class.

A.8.1.4 Assessment shall take into consideration not only significant changes in a single organ or biological system but also generalized changes of a less severe nature involving several organs.

A.8.1.5 Specific target organ toxicity can occur by any route that is relevant for humans, i.e., principally oral, dermal or inhalation.

A.8.1.6 The classification criteria for specific organ systemic toxicity single exposure are organized as criteria for substances Categories 1 and 2 (See A.8.2.1), criteria for substances Category 3 (See A.8.2.2) and criteria for mixtures (See A.8.3). See also Figure A.8.1.

A.8.2 Classification Criteria for Substances

A.8.2.1 Substances of Category 1 and Category 2

A.8.2.1.1 Substances shall be classified for immediate or delayed effects separately, by the use of expert judgment on the basis of the weight of all evidence available, including the use of recommended guidance values (See A.8.2.1.9). Substances shall then be classified in Category 1 or 2, depending upon the nature and severity of the effect(s) observed, in accordance with Figure A.8.1.

FIGURE A.8.1—HAZARD CATEGORIES FOR SPECIFIC TARGET ORGAN TOXICITY FOLLOWING SINGLE EXPOSURE

CATEGORY 1: Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following single exposure

Substances are classified in Category 1 for STOT–SE on the basis of:

(a) reliable and good quality evidence from human cases or epidemiological studies; or

(b) observations from appropriate studies in experimental animals in which significant and/or severe toxic effects of relevance to human health were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) to be used as part of weight-of-evidence evaluation.

CATEGORY 2: Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following single exposure

Substances are classified in Category 2 for STOT–SE on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values are provided below (See A.8.2.1.9) in order to help in classification.

In exceptional cases, human evidence can also be used to place a substance in Category 2 (See A.8.2.1.6).

CATEGORY 3: Transient target organ effects

There are target organ effects for which a substance does not meet the criteria to be classified in Categories 1 or 2 indicated above. These are effects which adversely alter human function for a short duration after exposure and from which humans may recover in a reasonable period without leaving significant alteration of structure or function. This category only includes narcotic effects and respiratory tract irritation. Substances are classified specifically for these effects as discussed in A.8.2.2.

Note: The primary target organ/system shall be identified where possible, and where this is not possible, the substance shall be identified as a general toxicant. The data shall be evaluated and, where possible, shall not include secondary effects (e.g., a hepatotoxicant can produce secondary effects in the nervous or gastro-intestinal systems).

A.8.2.1.2 The relevant route(s) of exposure by which the classified substance produces damage shall be identified.

A.8.2.1.3 Classification is determined by expert judgment, on the basis of the weight of all evidence available including the guidance presented below.

A.8.2.1.4 Weight of evidence of all available data, including human incidents, epidemiology, and studies conducted in experimental animals is used to substantiate specific target organ toxic effects that merit classification.

A.8.2.1.5 The information required to evaluate specific target organ toxicity comes either from single exposure in humans (e.g., exposure at home, in the workplace or environmentally), or from studies conducted in experimental animals. The standard animal studies in rats or mice that provide this information are acute toxicity studies which can include clinical observations and detailed macroscopic and microscopic examination to enable the toxic effects on target tissues/organs to be identified. Results of acute toxicity studies conducted in other species may also provide relevant information.

A.8.2.1.6 In exceptional cases, based on expert judgment, it may be appropriate to place certain substances with human evidence of target organ toxicity in Category 2: (a) when the weight of human evidence is not sufficiently convincing to warrant Category 1 classification, and/or (b) based on the nature and severity of effects. Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the Category 2 classification. In other words, if there are also animal data available on the substance that warrant Category 1 classification, the chemical shall be classified as Category 1.

A.8.2.1.7 Effects considered to support classification for Category 1 and 2

A.8.2.1.7.1 Classification is supported by evidence associating single exposure to the substance with a consistent and identifiable toxic effect.

A.8.2.1.7.2 Evidence from human experience/incidents is usually restricted to reports of adverse health consequences, often with uncertainty about exposure conditions, and may not provide the scientific detail that can be obtained from well-conducted studies in experimental animals.

A.8.2.1.7.3 Evidence from appropriate studies in experimental animals can furnish much more detail, in the form of clinical observations, and macroscopic and microscopic pathological examination and this can often reveal hazards that may not be life-threatening but could indicate functional impairment. Consequently all available evidence, and evidence relevance to human health, must be taken into consideration in the classification process. Relevant toxic effects in humans and/or animals include, but are not limited to:

(a) Morbidity resulting from single exposure;

(b) Significant functional changes, more than transient in nature, in the respiratory system, central or peripheral nervous systems, other organs or other organ systems, including signs of central nervous system depression and effects on special senses (e.g., sight, hearing and sense of smell);

(c) Any consistent and significant adverse change in clinical biochemistry, hematology, or urinalysis parameters;

(d) Significant organ damage that may be noted at necropsy and/or subsequently seen or confirmed at microscopic examination;

(e) Multi-focal or diffuse necrosis, fibrosis or granuloma formation in vital organs with regenerative capacity;

(f) Morphological changes that are potentially reversible but provide clear evidence of marked organ dysfunction; and,

(g) Evidence of appreciable cell death (including cell degeneration and reduced cell number) in vital organs incapable of regeneration.

A.8.2.1.8 Effects considered not to support classification for Category 1 and 2

Effects may be seen in humans and/or animals that do not justify classification. Such effects include, but are not limited to:

(a) Clinical observations or small changes in bodyweight gain, food consumption or water intake that may have some toxicological importance but that do not, by themselves, indicate "significant" toxicity;

(b) Small changes in clinical biochemistry, hematology or urinalysis parameters and/or transient effects, when such changes or effects are of doubtful or of minimal toxicological importance;

(c) Changes in organ weights with no evidence of organ dysfunction;

(d) Adaptive responses that are not considered toxicologically relevant; and,

(e) Substance-induced species-specific mechanisms of toxicity, i.e., demonstrated with reasonable certainty to be not relevant for human health, shall not justify classification.

A.8.2.1.9 Guidance values to assist with classification based on the results obtained from studies conducted in experimental animals for Category 1 and 2

A.8.2.1.9.1 In order to help reach a decision about whether a substance shall be classified or not, and to what degree it shall be classified (Category 1 vs. Category 2), dose/concentration "guidance values" are provided for consideration of the dose/concentration which has been shown to produce significant health effects. The principal argument for proposing such guidance values is that all chemicals are potentially toxic and there has to be a reasonable dose/concentration above which a degree of toxic effect is acknowledged.

A.8.2.1.9.2 Thus, in animal studies, when significant toxic effects are observed that indicate classification, consideration of the dose/concentration at which these effects were seen, in relation to the suggested guidance values, provides useful information to help assess the need to classify (since the toxic effects are a consequence of the hazardous property(ies) and also the dose/concentration).

A.8.2.1.9.3 The guidance value (C) ranges for single-dose exposure which has produced a significant non-lethal toxic effect are those applicable to acute toxicity testing, as indicated in Table A.8.1.

TABLE A.8.1—GUIDANCE VALUE RANGES FOR SINGLE-DOSE EXPOSURES

Route of exposure	Units	Guidance value ranges for:		
		Category 1	Category 2	Category 3
Oral (rat)	mg/kg body weight	C ≤300	2000 ≥C >300	Guidance values do not apply.
Dermal (rat or rabbit)	mg/kg body weight	C ≤1,000	2000 ≥C >1,000.	
Inhalation (rat) gas	ppmV/4h	C ≤2,500	20,000 ≥C >2,500.	
Inhalation (rat) vapor	mg/1/4h	C ≤10	20 ≥C >10.	
Inhalation (rat) dust/mist/fume.	mg/l/4h	C ≤1.0	5.0 ≥C >1.0.	

A.8.2.1.9.4 The guidance values and ranges mentioned in Table A.8.1 are intended only for guidance purposes, i.e., 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. Guidance values are not provided for Category 3 since this classification is primarily based on human data; animal data may be included in the weight of evidence evaluation.

A.8.2.1.9.5 Thus, it is feasible that a specific profile of toxicity occurs at a dose/concentration below the guidance value, e.g., <2000 mg/kg body weight by the oral route, however the nature of the effect may result in the decision not to classify. Conversely, a specific profile of toxicity may be seen in animal studies occurring at above a guidance value, e.g., ≥2000 mg/kg body weight by the oral route, and in addition there is supplementary information from other sources, e.g., other single dose studies, or human case experience, which supports a conclusion that, in view of the weight of evidence, classification is the prudent action to take.

A.8.2.1.10 Other considerations

A.8.2.1.10.1 When a substance is characterized only by use of animal data the classification process includes reference to dose/concentration guidance values as one of

the elements that contribute to the weight of evidence approach.

A.8.2.1.10.2 When well-substantiated human data are available showing a specific target organ toxic effect that can be reliably attributed to single exposure to a substance, the substance shall be classified. Positive human data, regardless of probable dose, predominates over animal data. Thus, if a substance is unclassified because specific target organ toxicity observed was considered not relevant or significant to humans, if subsequent human incident data become available showing a specific target organ toxic effect, the substance shall be classified.

A.8.2.1.10.3 A substance that has not been tested for specific target organ toxicity shall, where appropriate, be classified on the basis of data from a scientifically validated structure activity relationship and expert judgment-based extrapolation from a structural analogue that has previously been classified together with substantial support from consideration of other important factors such as formation of common significant metabolites.

A.8.2.2 Substances of Category 3

A.8.2.2.1 Criteria for respiratory tract irritation

The criteria for classifying substances as Category 3 for respiratory tract irritation are:

(a) Respiratory irritant effects (characterized by localized redness, edema, pruritis and/or pain) that impair function with symptoms such as cough, pain, choking, and breathing difficulties are included. It is recognized that this evaluation is based primarily on human data;

(b) Subjective human observations supported by objective measurements of clear respiratory tract irritation (RTI) (e.g., electrophysiological responses, biomarkers of inflammation in nasal or bronchoalveolar lavage fluids);

(c) The symptoms observed in humans shall also be typical of those that would be produced in the exposed population rather than being an isolated idiosyncratic reaction or response triggered only in individuals with hypersensitive airways. Ambiguous reports simply of "irritation" should be excluded as this term is commonly used to describe a wide range of sensations including those such as smell, unpleasant taste, a tickling sensation, and dryness, which are outside the scope of classification for respiratory tract irritation;

(d) There are currently no scientifically validated animal tests that deal specifically with RTI; however, useful information may be obtained from the single and repeated inhalation toxicity tests. For example, animal studies may provide useful information in terms of clinical signs of toxicity (dyspnoea, rhinitis etc) and histopathology (e.g., hyperemia, edema, minimal inflammation, thickened mucous layer) which are reversible and may be reflective of the characteristic clinical symptoms described above. Such animal studies can be used as part of weight of evidence evaluation; and,

(e) This special classification will occur only when more severe organ effects including the respiratory system are not observed as those effects would require a higher classification.

A.8.2.2.2 Criteria for narcotic effects

The criteria for classifying substances in Category 3 for narcotic effects are:

(a) Central nervous system depression including narcotic effects in humans such as drowsiness, narcosis, reduced alertness, loss of reflexes, lack of coordination, and vertigo are included. These effects can also be manifested as severe headache or nausea, and can lead to reduced judgment, dizziness, irritability, fatigue, impaired memory function, deficits in perception and coordination, reaction time, or sleepiness; and,

(b) Narcotic effects observed in animal studies may include lethargy, lack of coordination righting reflex, narcosis, and ataxia. If these effects are not transient in nature, then they shall be considered for classification as Category 1 or 2.

A.8.3 Classification Criteria for Mixtures

A.8.3.1 Mixtures are classified using the same criteria as for substances, or alternatively as described below. As with substances, mixtures may be classified for specific target organ toxicity following single exposure, repeated exposure, or both.

A.8.3.2 Classification of Mixtures When Data Are Available for the Complete Mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of this data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis, do not render the results inconclusive.

A.8.3.3 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.8.3.3.1 Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution, Batching, Concentration of mixtures, Interpolation within one toxicity category, Substantially similar mixtures, or Aerosols.

A.8.3.4 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.8.3.4.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following single exposure, repeated exposure, or both when at least one ingredient has been classified as a Category 1 or Category 2 specific target organ toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.8.2 for Categories 1 and 2, respectively.

TABLE A.8.2—CUT-OFF VALUES/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS A SPECIFIC TARGET ORGAN TOXICANT THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS CATEGORY 1 OR 2

Ingredient classified as:	Cut-off values/concentration limits triggering classification of a mixture as:	
	Category 1	Category 2
Category 1 Target organ toxicant	≥1.0%	.....
Category 2 Target organ toxicant	.....	≥1.0%

A.8.3.4.2 These cut-off values and consequent classifications shall be applied equally and appropriately to both single- and repeated-dose target organ toxicants.

A.8.3.4.3 Mixtures shall be classified for either or both single and repeated dose toxicity independently.

A.8.3.4.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause target organ toxicity at <1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

A.8.3.4.5 Care shall be exercised when extrapolating the toxicity of a mixture that contains Category 3 ingredient(s). A cut-off value/concentration limit of 20%, considered as an additive of all Category 3 ingredients for each hazard endpoint, is appropriate; however, this cut-off value/concentration limit may be higher or lower depending on the Category 3 ingredient(s) involved and the fact that some effects such as respiratory tract irritation may not occur below a certain concentration while other effects such as narcotic effects may occur below this 20% value. Expert judgment shall be exercised. Respiratory tract irritation and narcotic

effects are to be evaluated separately in accordance with the criteria given in A.8.2.2. When conducting classifications for these hazards, the contribution of each ingredient should be considered additive, unless there is evidence that the effects are not additive.

A.9 SPECIFIC TARGET ORGAN TOXICITY REPEATED OR PROLONGED EXPOSURE

A.9.1 Definitions and general considerations

A.9.1.1 *Specific target organ toxicity—repeated exposure (STOT–RE)* means specific target organ toxicity arising from repeated exposure to a substance or mixture. All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed and not specifically addressed in A.1 to A.7 and A.10 of this Appendix are included. Specific target organ toxicity following a single-event exposure is classified in accordance with *SPECIFIC TARGET ORGAN TOXICITY—SINGLE EXPOSURE* (A.8 of this Appendix) and is therefore not included here.

A.9.1.2 Classification identifies the substance or mixture as being a specific target organ toxicant and, as such, it may present a potential for adverse health effects in people who are exposed to it.

A.9.1.3 These adverse health effects produced by repeated exposure include consistent and identifiable toxic effects in humans, or, in experimental animals, toxicologically significant changes which have affected the function or morphology of a tissue/organ, or have produced serious changes to the biochemistry or hematology of the organism and these changes are relevant for human health. Human data will be the primary source of evidence for this hazard class.

A.9.1.4 Assessment shall take into consideration not only significant changes in a single organ or biological system but also generalized changes of a less severe nature involving several organs.

A.9.1.5 Specific target organ toxicity can occur by any route that is relevant for humans, e.g., principally oral, dermal or inhalation.

A.9.2 Classification Criteria for Substances

A.9.2.1 Substances shall be classified as STOT–RE by expert judgment on the basis of the weight of all evidence available, including the use of recommended guidance values which take into account the duration of exposure and the dose/concentration which produced the effect(s), (See A.9.2.9). Substances shall be placed in one of two categories, depending upon the nature and severity of the effect(s) observed, in accordance with Figure A.9.1.

FIGURE A.9.1—HAZARD CATEGORIES FOR SPECIFIC TARGET ORGAN TOXICITY FOLLOWING REPEATED EXPOSURE

CATEGORY 1: Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following repeated or prolonged exposure

Substances are classified in Category 1 for specific target organ toxicity (repeated exposure) on the basis of:

(a) reliable and good quality evidence from human cases or epidemiological studies; or,

(b) observations from appropriate studies in experimental animals in which significant and/or severe toxic effects, of relevance to human health, were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) to be used as part of weight-of-evidence evaluation.

CATEGORY 2: Substances that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to be harmful to human health following repeated or prolonged exposure

Substances are classified in Category 2 for specific target organ toxicity (repeated exposure) on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values are provided below (See A.9.2.9) in order to help in classification.

In exceptional cases human evidence can also be used to place a substance in Category 2 (See A.9.2.6).

Note: The primary target organ/system shall be identified where possible, or the substance shall be identified as a general toxicant. The data shall be carefully evaluated and, where possible, shall not include secondary effects (e.g., a hepatotoxicant can produce secondary effects in the nervous or gastro-intestinal systems).

A.9.2.2 The relevant route of exposure by which the classified substance produces damage shall be identified.

A.9.2.3 Classification is determined by expert judgment, on the basis of the weight of all evidence available including the guidance presented below.

A.9.2.4 Weight of evidence of all data, including human incidents, epidemiology, and studies conducted in experimental animals, is used to substantiate specific target organ toxic effects that merit classification.

A.9.2.5 The information required to evaluate specific target organ toxicity comes either from repeated exposure in humans, e.g., exposure at home, in the workplace or environmentally, or from studies conducted in experimental animals. The standard animal studies in rats or mice that provide this information are 28 day, 90 day or lifetime studies (up to 2 years) that include hematological, clinico-chemical and detailed macroscopic and microscopic examination to enable the toxic effects on target tissues/organs to be identified. Data from repeat dose studies performed in other species may also be used. Other long-term exposure studies, e.g., for carcinogenicity, neurotoxicity or reproductive toxicity, may also provide evidence of specific target organ toxicity that could be used in the assessment of classification.

A.9.2.6 In exceptional cases, based on expert judgment, it may be appropriate to place certain substances with human evidence of specific target organ toxicity in Category 2: (a) when the weight of human evidence is not sufficiently convincing to warrant Category 1 classification, and/or (b) based on the nature and severity of effects. Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the Category 2 classification. In other words, if there are also animal data available on the substance that warrant Category 1 classification, the substance shall be classified as Category 1.

A.9.2.7 Effects Considered To Support Classification

A.9.2.7.1 Classification is supported by reliable evidence associating repeated exposure to the substance with a consistent and identifiable toxic effect.

A.9.2.7.2 Evidence from human experience/incidents is usually restricted to reports of adverse health consequences, often with uncertainty about exposure conditions, and may not provide the scientific detail that can be obtained from well-conducted studies in experimental animals.

A.9.2.7.3 Evidence from appropriate studies in experimental animals can furnish much more detail, in the form of clinical observations, hematology, clinical chemistry, macroscopic and microscopic pathological examination and this can often reveal hazards that may not be life-threatening but could indicate functional impairment. Consequently all available evidence, and relevance to human health, must be taken into consideration in the classification process. Relevant toxic effects in humans and/or animals include, but are not limited to:

(a) Morbidity or death resulting from repeated or long-term exposure. Morbidity or death may result from repeated exposure, even to relatively low doses/concentrations, due to bioaccumulation of the substance or its metabolites, or due to the overwhelming of the de-toxification process by repeated exposure;

(b) Significant functional changes in the central or peripheral nervous systems or other organ systems, including signs of central nervous system depression and effects on special senses (e.g., sight, hearing and sense of smell);

(c) Any consistent and significant adverse change in clinical biochemistry, hematology, or urinalysis parameters;

(d) Significant organ damage that may be noted at necropsy and/or subsequently seen or confirmed at microscopic examination;

(e) Multi-focal or diffuse necrosis, fibrosis or granuloma formation in vital organs with regenerative capacity;

(f) Morphological changes that are potentially reversible but provide clear evidence of marked organ dysfunction (e.g., severe fatty change in the liver); and,

(g) Evidence of appreciable cell death (including cell degeneration and reduced cell number) in vital organs incapable of regeneration.

A.9.2.8 Effects Considered Not To Support Classification

Effects may be seen in humans and/or animals that do not justify classification. Such effects include, but are not limited to:

(a) Clinical observations or small changes in bodyweight gain, food consumption or water intake that may have some toxicological importance but that do not, by themselves, indicate "significant" toxicity;

(b) Small changes in clinical biochemistry, hematology or urinalysis parameters and/or transient effects, when such changes or effects are of doubtful or of minimal toxicological importance;

(c) Changes in organ weights with no evidence of organ dysfunction;

(d) Adaptive responses that are not considered toxicologically relevant;

(e) Substance-induced species-specific mechanisms of toxicity, i.e., demonstrated with reasonable certainty to be not relevant for human health, shall not justify classification.

A.9.2.9 Guidance Values To Assist With Classification Based on the Results Obtained From Studies Conducted in Experimental Animals

A.9.2.9.1 In studies conducted in experimental animals, reliance on observation of effects alone, without reference to the duration of experimental exposure and dose/concentration, omits a fundamental concept of toxicology, i.e., all substances are potentially toxic, and what determines the toxicity is a function of the dose/concentration and the duration of exposure. In most studies conducted in experimental animals the test guidelines use an upper limit dose value.

A.9.2.9.2 In order to help reach a decision about whether a substance shall be classified or not, and to what degree it shall be classified (Category 1 vs. Category 2), dose/concentration "guidance values" are provided in Table A.9.1 for consideration of the dose/concentration which has been shown to produce significant health effects. The principal argument for proposing such guidance values is that all chemicals are potentially toxic and there has to be a reasonable dose/concentration above which a degree of toxic effect is acknowledged. Also, repeated-dose studies conducted in experimental animals are designed to produce toxicity at the highest dose used in order to optimize the test objective and so most studies will reveal some toxic effect at least at this highest dose. What is therefore to be decided is not only what effects have been produced, but also at what dose/concentration they were produced and how relevant is that for humans.

A.9.2.9.3 Thus, in animal studies, when significant toxic effects are observed that indicate classification, consideration of the duration of experimental exposure and the dose/concentration at which these effects were seen, in relation to the suggested guidance values, provides useful information to help assess the need to classify (since the toxic effects are a consequence of the hazardous property(ies) and also the duration of exposure and the dose/concentration).

A.9.2.9.4 The decision to classify at all can be influenced by reference to the dose/concentration guidance values at or below which a significant toxic effect has been observed.

A.9.2.9.5 The guidance values 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, using dose/exposure time extrapolation similar to Haber's rule for inhalation, which states essentially that the effective dose is directly proportional to the exposure concentration and the duration of exposure. The assessment should be done on a case-by-case basis; for example, for a 28-day study the guidance values below would be increased by a factor of three.

A.9.2.9.6 Thus for Category 1 classification, significant toxic effects observed in a 90-day repeated-dose study conducted in experimental animals and seen to occur at or below the (suggested) guidance values (C) as indicated in Table A.9.1 would justify classification:

TABLE A.9.1—GUIDANCE VALUES TO ASSIST IN CATEGORY 1 CLASSIFICATION

[Applicable to a 90-day study]

Route of exposure	Units	Guidance values (dose/concentration)
Oral (rat)	mg/kg body weight/day	C ≤10.
Dermal (rat or rabbit)	mg/kg body weight/day	C ≤20.
Inhalation (rat) gas	ppmV/6h/day	C ≤50.
Inhalation (rat) vapor	mg/liter/6h/day	C ≤0.2.
Inhalation (rat) dust/mist/fume	mg/liter/6h/day	C ≤0.02.

A.9.2.9.7 For Category 2 classification, significant toxic effects observed in a 90-day repeated-dose study conducted in experimental animals and seen to occur within the (suggested) guidance value ranges as indicated in Table A.9.2 would justify classification:

TABLE A.9.2—GUIDANCE VALUES TO ASSIST IN CATEGORY 2 CLASSIFICATION

[Applicable to a 90-day study]

Route of exposure	Units	Guidance values (dose/concentration)
Oral (rat)	mg/kg body weight/day	10 <C ≤100.
Dermal (rat or rabbit)	mg/kg body weight/day	20 <C ≤200.
Inhalation (rat) gas	ppmV/6h/day	50 <C ≤250.
Inhalation (rat) vapor	mg/liter/6h/day	0.2 <C ≤1.0.
Inhalation (rat) dust/mist/fume	mg/liter/6h/day	0.02 <C ≤0.2.

A.9.2.9.8 The guidance values and ranges mentioned in A.2.9.9.6 and A.2.9.9.7 are intended only for guidance purposes, i.e., 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.

A.9.2.9.9 Thus, it is possible that a specific profile of toxicity occurs in repeat-dose animal studies at a dose/concentration below the guidance value, e.g., <100 mg/kg body weight/day by the oral route, however the nature of the effect, e.g., nephrotoxicity seen only in male rats of a particular strain known to be susceptible to this effect, may result in the decision not to classify. Conversely, a specific profile of toxicity may be seen in animal studies occurring at above a guidance value, e.g., ≥100 mg/kg body weight/day by the oral route, and in addition there is supplementary information from other sources, e.g., other long-term administration studies, or human case experience, which supports a conclusion that, in view of the weight of evidence, classification is prudent.

A.9.2.10 Other Considerations

A.9.2.10.1 When a substance is characterized only by use of animal data the classification process includes reference to dose/concentration guidance values as one of the elements that contribute to the weight of evidence approach.

A.9.2.10.2 When well-substantiated human data are available showing a specific target organ toxic effect that can be reliably attributed to repeated or prolonged exposure to a substance, the substance shall be classified. Positive human data, regardless of probable dose, predominates over animal data. Thus, if a substance is unclassified because no specific target organ toxicity was seen at or below the dose/concentration guidance value for animal testing, if subsequent human incident data become available showing a specific target organ toxic effect, the substance shall be classified.

A.9.2.10.3 A substance that has not been tested for specific target organ toxicity may in certain instances, where appropriate, be classified on the basis of data from a scientifically validated structure activity relationship and expert judgment-based extrapolation from a structural analogue that has previously been classified together with substantial support from consideration of other important factors such as formation of common significant metabolites.

A.9.3 Classification Criteria for Mixtures

A.9.3.1 Mixtures are classified using the same criteria as for substances, or alternatively as described below. As with substances, mixtures may be classified for specific target organ toxicity following single exposure, repeated exposure, or both.

A.9.3.2 Classification of Mixtures When Data Are Available for the Complete Mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight of evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis, do not render the results inconclusive.

A.9.3.3 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.9.3.3.1 Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; Concentration of mixtures; Interpolation within one toxicity category; Substantially similar mixtures; and Aerosols.

A.9.3.4 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.9.3.4.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following single exposure, repeated exposure, or both when at least one ingredient has been classified as a Category 1 or Category 2 specific target organ toxicant and is present at or above the appropriate cut-off value/concentration limit specified in Table A.9.3 for Category 1 and 2 respectively.

TABLE A.9.3—CUT-OFF VALUE/CONCENTRATION LIMITS OF INGREDIENTS OF A MIXTURE CLASSIFIED AS A SPECIFIC TARGET ORGAN TOXICANT THAT WOULD TRIGGER CLASSIFICATION OF THE MIXTURE AS CATEGORY 1 OR 2

Ingredient classified as:	Cut-off values/concentration limits triggering classification of a mixture as:	
	Category 1	Category 2
Category 1 Target organ toxicant	≥1.0%	
Category 2 Target organ toxicant		≥1.0%

A.9.3.4.2 These cut-off values and consequent classifications shall be applied equally and appropriately to both single- and repeated-dose target organ toxicants.

A.9.3.4.3 Mixtures shall be classified for either or both single- and repeated-dose toxicity independently.

A.9.3.4.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause specific target organ toxicity at <1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

A.10 ASPIRATION HAZARD

A.10.1 Definitions and General and Specific Considerations

A.10.1.1 *Aspiration* means the entry of a liquid or solid chemical directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system.

A.10.1.2 Aspiration toxicity includes severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration.

A.10.1.3 Aspiration is initiated at the moment of inspiration, in the time required to take one breath, as the causative material lodges at the crossroad of the upper respiratory and digestive tracts in the laryngopharyngeal region.

A.10.1.4 Aspiration of a substance or mixture can occur as it is vomited following ingestion. This may have consequences for labeling, particularly where, due to acute toxicity, a recommendation may be considered to induce vomiting after ingestion. However, if the substance/mixture also presents an aspiration toxicity hazard, the recommendation to induce vomiting may need to be modified.

A.10.1.5 Specific Considerations

A.10.1.5.1 The classification criteria refer to kinematic viscosity. The following provides the conversion between dynamic and kinematic viscosity:

$$\frac{\text{Dynamic viscosity (mPa·s)}}{\text{Density (g/cm}^3\text{)}} = \text{Kinematic viscosity (mm}^2\text{/s)}$$

A.10.1.5.2 Although the definition of aspiration in A.10.1.1 includes the entry of solids into the respiratory system, classification according to (b) in table A.10.1 for Category 1 is intended to apply to liquid substances and mixtures only.

A.10.1.5.3 Classification of aerosol/mist products.

Aerosol and mist products are usually dispensed in containers such as self-pressurized containers, trigger and pump sprayers. Classification for these products shall be considered if their use may form a pool of product in the mouth, which then may be aspirated. If the mist or aerosol from a pressurized container is fine, a pool may not be formed. On the other hand, if a pressurized container dispenses product in a stream, a pool may be formed that may then be aspirated. Usually, the mist produced by trigger and pump sprayers is coarse and therefore, a pool may be formed that then may be aspirated. When the pump mechanism may be removed and contents are available to be swallowed then the classification of the products should be considered.

A.10.2 Classification Criteria for Substances

TABLE A.10.1—CRITERIA FOR ASPIRATION TOXICITY

Category	Criteria
Category 1: Chemicals known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazard.	A substance shall be classified in Category 1: (a) If reliable and good quality human evidence indicates that it causes aspiration toxicity (See note); or (b) If it is a hydrocarbon and has a kinematic viscosity ≤20.5 mm²/s, measured at 40 °C.

Note: Examples of substances included in Category 1 are certain hydrocarbons, turpentine and pine oil.

A.10.3 Classification Criteria for Mixtures

A.10.3.1 Classification When Data Are Available for the Complete Mixture

A mixture shall be classified in Category 1 based on reliable and good quality human evidence.

A.10.3.2 Classification of Mixtures When Data Are Not Available for the Complete Mixture: Bridging Principles

A.10.3.2.1 Where the mixture itself has not been tested to determine its aspiration toxicity, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately characterize the hazard of the mixture, these data shall be used in accordance with the following bridging principles as found in paragraph A.0.5 of this Appendix: Dilution; Batching; Concentration of mixtures; Interpolation within one toxicity category; and Substantially similar mixtures. For application of the dilution bridging principle, the concentration of aspiration toxicants shall not be less than 10%.

A.10.3.3 Classification of Mixtures When Data Are Available for All Ingredients or Only for Some Ingredients of the Mixture

A.10.3.3.1 A mixture which contains ≥10% of an ingredient or ingredients classified in Category 1, and has a kinematic viscosity ≤20.5 mm²/s, measured at 40 °C, shall be classified in Category 1.

A.10.3.3.2 In the case of a mixture which separates into two or more distinct layers, one of which contains ≥10% of an ingredient or ingredients classified in Category 1 and has a kinematic viscosity ≤20.5 mm²/s, measured at 40 °C, then the entire mixture shall be classified in Category 1.

APPENDIX B TO § 1910.1200—PHYSICAL CRITERIA (MANDATORY)

B.1 EXPLOSIVES

B.1.1 Definitions and General Considerations

B.1.1.1 An *explosive chemical* is a solid or liquid chemical 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 chemicals are included even when they do not evolve gases.

A *pyrotechnic chemical* is a chemical 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.

An *explosive item* is an item containing one or more explosive chemicals.

A *pyrotechnic item* is an item containing one or more pyrotechnic chemicals.

An *unstable explosive* is an explosive which is thermally unstable and/or too sensitive for normal handling, transport, or use.

An *intentional explosive* is a chemical or item which is manufactured with a view to produce a practical explosive or pyrotechnic effect.

B.1.1.2 The class of explosives comprises:

(a) Explosive chemicals;

(b) Explosive items, except devices containing explosive chemicals in such quantity or of such a character that their inadvertent or accidental ignition or initiation shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise; and

(c) Chemicals and items not included under (a) and (b) above which are manufactured with the view to producing a practical explosive or pyrotechnic effect.

B.1.2 Classification Criteria

Chemicals and items of this class shall be classified as unstable explosives or shall be assigned to one of the following six divisions depending on the type of hazard they present:

(a) Division 1.1—Chemicals and items which have a mass explosion hazard (a mass explosion is one which affects almost the entire quantity present virtually instantaneously);

(b) Division 1.2—Chemicals and items which have a projection hazard but not a mass explosion hazard;

(c) Division 1.3—Chemicals and items which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard:

(i) Combustion of which gives rise to considerable radiant heat; or

(ii) Which burn one after another, producing minor blast or projection effects or both;

(d) Division 1.4—Chemicals and items which present no significant hazard: chemicals and items which present only a small hazard in the event of ignition or initiation. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package;

(e) Division 1.5—Very insensitive chemicals which have a mass explosion hazard: chemicals which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions;

(f) Division 1.6—Extremely insensitive items which do not have a mass explosion hazard: items which contain only extremely insensitive detonating chemicals and which demonstrate a negligible probability of accidental initiation or propagation.

B.1.3 Additional Classification Considerations

B.1.3.1 Explosives shall be classified as unstable explosives or shall be assigned to one of the six divisions identified in B.1.2 in accordance with the three step procedure in Part I of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6). The first step is to ascertain whether the substance or mixture has explosive effects (Test Series 1). The second step is the acceptance procedure (Test Series 2 to 4) and the third step is the assignment to a hazard division (Test Series 5 to 7). The assessment whether a candidate for "ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives (ANE)" is insensitive enough for inclusion as an oxidizing liquid (See B.13) or an oxidizing solid (See B.14) is determined by Test Series 8 tests.

Note: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same

chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.1.3.2 Explosive properties are associated with the presence of certain chemical groups in a molecule which can react to produce very rapid increases in temperature or pressure. The screening procedure in B.1.3.1 is aimed at identifying the presence of such reactive groups and the potential for rapid energy release. If the screening procedure identifies the chemical as a potential explosive, the acceptance procedure (See section 10.3 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6)) is necessary for classification.

Note: Neither a Series 1 type (a) propagation of detonation test nor a Series 2 type (a) test of sensitivity to detonative shock is necessary if the exothermic decomposition energy of organic materials is less than 800 J/g.

B.1.3.3 If a mixture contains any known explosives, the acceptance procedure is necessary for classification.

B.1.3.4 A chemical is not classified as explosive if:

(a) There are no chemical groups associated with explosive properties present in the molecule. Examples of groups which may indicate explosive properties are given in Table A6.1 in Appendix 6 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6); or

(b) The substance contains chemical groups associated with explosive properties which include oxygen and the calculated oxygen balance is less than −200.

The oxygen balance is calculated for the chemical reaction:

$$C_xH_yO_z + [x + (y/4) - (z/2)]\ O_2 \rightarrow x.\ CO_2 + (y/2)\ H_2O$$

using the formula:

oxygen balance = −1600 [2x +(y/2) −z]/ molecular weight;

or

(c) The organic substance or a homogenous mixture of organic substances contains chemical groups associated with explosive properties but the exothermic decomposition energy is less than 500 J/g and the onset of exothermic decomposition is below 500 °C (932 °F). The exothermic decomposition energy may be determined using a suitable calorimetric technique; or

(d) For mixtures of inorganic oxidizing substances with organic material(s), the concentration of the inorganic oxidizing substance is:

(i) Less than 15%, by mass, if the oxidizing substance is assigned to Category 1 or 2;

(ii) Less than 30%, by mass, if the oxidizing substance is assigned to Category 3.

B.2 FLAMMABLE GASES

B.2.1 Definition

Flammable gas means a gas having a flammable range with air at 20 °C (68 °F) and a standard pressure of 101.3 kPa (14.7 psi).

B.2.2 Classification Criteria

A flammable gas shall be classified in one of the two categories for this class in accordance with Table B.2.1:

TABLE B.2.1—CRITERIA FOR FLAMMABLE GASES

Category	Criteria
1	Gases, which at 20 °C (68 °F) and a standard pressure of 101.3 kPa (14.7 psi): (a) are ignitable when in a mixture of 13% or less by volume in air; or (b) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit.
2	Gases, other than those of Category 1, which, at 20 °C (68 °F) and a standard pressure of 101.3 kPa (14.7 psi), have a flammable range while mixed in air.

Note: Aerosols should not be classified as flammable gases. See B.3.

B.2.3 Additional Classification Considerations

Flammability shall be determined by tests or by calculation in accordance with ISO 10156 (incorporated by reference; See § 1910.6). Where insufficient data are available to use this method, equivalent validated methods may be used.

B.3 FLAMMABLE AEROSOLS

B.3.1 Definition

Aerosol means any non-refillable receptacle containing a gas compressed, liquefied or dissolved under pressure, and fitted with a release device allowing the contents to be ejected as particles in suspension in a gas, or as a foam, paste, powder, liquid or gas.

B.3.2 Classification Criteria

B.3.2.1 Aerosols shall be considered for classification as flammable if they contain any component which is classified as flammable in accordance with this Appendix, i.e.:

Flammable liquids (See B.6);
Flammable gases (See B.2);
Flammable solids (See B.7).

Note 1: Flammable components do not include pyrophoric, self-heating or water-reactive chemicals.

Note 2: Flammable aerosols do not fall additionally within the scope of flammable gases, flammable liquids, or flammable solids.

B.3.2.2 A flammable aerosol shall be classified in one of the two categories for this class in accordance with Table B.3.1.

TABLE B.3.1—CRITERIA FOR FLAMMABLE AEROSOLS

Category	Criteria
1	Contains ≥85% flammable components and the chemical heat of combustion is ≥30 kJ/g; or (a) For spray aerosols, in the ignition distance test, ignition occurs at a distance ≥75 cm (29.5 in), or (b) For foam aerosols, in the aerosol foam flammability test. (i) The flame height is ≥20 cm (7.87 in) and the flame duration ≥2 s; or (ii) The flame height is ≥4 cm (1.57 in) and the flame duration ≥7 s.
2	Contains >1% flammable components, or the heat of combustion is ≥20 kJ/g; and (a) for spray aerosols, in the ignition distance test, ignition occurs at a distance ≥15 cm (5.9 in), or in the enclosed space ignition test, the (i) Time equivalent is ≤300 s/m³; or (ii) Deflagration density is ≤300 g/m³. (b) For foam aerosols, in the aerosol foam flammability test, the flame height is ≥4 cm and the flame duration is ≥2 s and it does not meet the criteria for Category 1.

Note: Aerosols not submitted to the flammability classification procedures in this Appendix shall be classified as extremely flammable (Category 1).

B.3.3 Additional Classification Considerations

B.3.3.1 To classify a flammable aerosol, data on its flammable components, on its chemical heat of combustion and, if applicable, the results of the aerosol foam flammability test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols) are necessary.

B.3.3.2 The chemical heat of combustion (ΔHc), in kilojoules per gram (kJ/g), is the product of the theoretical heat of combustion (ΔHcomb), and a combustion efficiency, usually less than 1.0 (a typical combustion efficiency is 0.95 or 95%).

For a composite aerosol formulation, the chemical heat of combustion is the summation of the weighted heats of combustion for the individual components, as follows:

$$\Delta Hc\ (\text{product}) = \sum_{i}^{n} [\ wi\% \times \Delta Hc(i)]$$

Where:

ΔHc = chemical heat of combustion (kJ/g);
wi% = mass fraction of component i in the product;
ΔHc(i) = specific heat of combustion (kJ/g) of component i in the product;

The chemical heats of combustion shall be found in literature, calculated or determined by tests (See ASTM D240–02, ISO 13943, Sections 86.1 to 86.3, and NFPA 30B (incorporated by reference; See § 1910.6)).

B.3.3.3 The Ignition Distance Test, Enclosed Space Ignition Test and Aerosol Foam Flammability Test shall be performed in accordance with sub-sections 31.4, 31.5 and 31.6 of the of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6).

B.4 OXIDIZING GASES

B.4.1 Definition

Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

Note: "Gases which cause or contribute to the combustion of other material more than air does" means pure gases or gas mixtures with an oxidizing power greater than 23.5% (as determined by a method specified in ISO 10156 or 10156–2 (incorporated by reference, See § 1910.6) or an equivalent testing method.)

B.4.2 Classification Criteria

An oxidizing gas shall be classified in a single category for this class in accordance with Table B.4.1:

TABLE B.4.1—CRITERIA FOR OXIDIZING GASES

Category	Criteria
1	Any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

B.4.3 Additional Classification Considerations

Classification shall be in accordance with tests or calculation methods as described in ISO 10156 (incorporated by reference; See § 1910.6) and ISO 10156–2 (incorporated by reference; See § 1910.6).

B.5 GASES UNDER PRESSURE

B.5.1 Definition

Gases under pressure are gases which are contained in a receptacle at a pressure of 200 kPa (29 psi) (gauge) or more, or which are liquefied or liquefied and refrigerated.

They comprise compressed gases, liquefied gases, dissolved gases and refrigerated liquefied gases.

B.5.2 Classification Criteria

Gases under pressure shall be classified in one of four groups in accordance with Table B.5.1:

TABLE B.5.1—CRITERIA FOR GASES UNDER PRESSURE

Group	Criteria
Compressed gas	A gas which when under pressure is entirely gaseous at −50 °C (−8 °F), including all gases with a critical temperature[1] ≤−50 °C (−58 °F).
Liquefied gas	A gas which when under pressure is partially liquid at temperatures above −50 °C (−58 °F). A distinction is made between: (a) High pressure liquefied gas: A gas with a critical temperature[1] between −50 °C (−58 °F) and +65 °C (149 °F); and (b) Low pressure liquefied gas: A gas with a critical temperature[1] above +65 °C (149 °F).
Refrigerated liquefied gas	A gas which is made partially liquid because of its low temperature.
Dissolved gas	A gas which when under pressure is dissolved in a liquid phase solvent.

[1] *The critical temperature is the temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.*

B.6 FLAMMABLE LIQUIDS

B.6.1 Definition

Flammable liquid means a liquid having a flash point of not more than 93 °C (199.4 °F).

Flash point means the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid, as determined by a method identified in Section B.6.3.

B.6.2 Classification Criteria

A flammable liquid shall be classified in one of four categories in accordance with Table B.6.1:

TABLE B.6.1—CRITERIA FOR FLAMMABLE LIQUIDS

Category	Criteria
1	Flash point <23 °C (73.4 °F) and initial boiling point ≤35 °C (95 °F).

TABLE B.6.1—CRITERIA FOR FLAMMABLE LIQUIDS—Continued

Category	Criteria
2	Flash point <23 °C (73.4 °F) and initial boiling point >35 °C (95 °F).
3	Flash point ≥23 °C (73.4 °F) and ≤60 °C (140 °F).
4	Flash point >60 °C (140 °F) and ≤93 °C (199.4 °F).

B.6.3 Additional Classification Considerations

The flash point shall be determined in accordance with ASTM D56–05, ASTM D3278, ASTM D3828, ASTM D93–08 (incorporated by reference; See § 1910.6), or any other method specified in GHS Revision 3, Chapter 2.6.

The initial boiling point shall be determined in accordance with ASTM D86–07a or ASTM D1078 (incorporated by reference; See § 1910.6).

B.7 FLAMMABLE SOLIDS

B.7.1 Definitions

Flammable solid means a solid which is a readily combustible solid, or which may cause or contribute to fire through friction.

Readily combustible solids are powdered, granular, or pasty chemicals 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.

B.7.2 Classification Criteria

B.7.2.1 Powdered, granular or pasty chemicals shall be classified as flammable solids when the time of burning of one or more of the test runs, performed in accordance with the test method described in the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), Part III, sub-section 33.2.1, is less than 45 s or the rate of burning is more than 2.2 mm/s (0.0866 in/s).

B.7.2.2 Powders of metals or metal alloys shall be classified as flammable solids when they can be ignited and the reaction spreads over the whole length of the sample in 10 min or less.

B.7.2.3 Solids which may cause fire through friction shall be classified in this class by analogy with existing entries (e.g., matches) until definitive criteria are established.

B.7.2.4 A flammable solid shall be classified in one of the two categories for this class using Method N.1 as described in Part III, sub-section 33.2.1 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.7.1:

TABLE B.7.1—CRITERIA FOR FLAMMABLE SOLIDS

Category	Criteria
1	Burning rate test: Chemicals other than metal powders: (a) Wetted zone does not stop fire; and (b) Burning time <45 s or burning rate >2.2 mm/s. Metal powders: Burning time ≤5 min.
2	Burning rate test: Chemicals other than metal powders: (a) Wetted zone stops the fire for at least 4 min; and (b) Burning time <45 s or burning rate >2.2 mm/s. Metal powders: Burning time >5 min and ≤10 min.

Note: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.8 SELF-REACTIVE CHEMICALS

B.8.1 Definitions

Self-reactive chemicals are thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes chemicals classified under this section as explosives, organic peroxides, oxidizing liquids or oxidizing solids.

A self-reactive chemical is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

B.8.2 Classification Criteria

B.8.2.1 A self-reactive chemical shall be considered for classification in this class unless:

(a) It is classified as an explosive according to B.1 of this appendix;

(b) It is classified as an oxidizing liquid or an oxidizing solid according to B.13 or B.14 of this appendix, except that a mixture of oxidizing substances which contains 5% or more of combustible organic substances shall be classified as a self-reactive chemical according to the procedure defined in B.8.2.2;

(c) It is classified as an organic peroxide according to B.15 of this appendix;

(d) Its heat of decomposition is less than 300 J/g; or

(e) Its self-accelerating decomposition temperature (SADT) is greater than 75 °C (167 °F) for a 50 kg (110 lb) package.

B.8.2.2 Mixtures of oxidizing substances, meeting the criteria for classification as oxidizing liquids or oxidizing solids, which contain 5% or more of combustible organic substances and which do not meet the criteria mentioned in B.8.2.1 (a), (c), (d) or (e), shall be subjected to the self-reactive chemicals classification procedure in B.8.2.3. Such a mixture showing the properties of a self-reactive chemical type B to F shall be classified as a self-reactive chemical.

B.8.2.3 Self-reactive chemicals shall be classified in one of the seven categories of "types A to G" for this class, according to the following principles:

(a) Any self-reactive chemical which can detonate or deflagrate rapidly, as packaged, will be defined as self-reactive chemical TYPE A;

(b) Any self-reactive chemical possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package will be defined as self-reactive chemical TYPE B;

(c) Any self-reactive chemical possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion will be defined as self-reactive chemical TYPE C;

(d) Any self-reactive chemical which in laboratory testing meets the criteria in (d)(i), (ii), or (iii) will be defined as self-reactive chemical TYPE D:

(i) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or

(ii) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or

(iii) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement;

(e) Any self-reactive chemical which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement will be defined as self-reactive chemical TYPE E;

(f) Any self-reactive chemical which, in laboratory testing, neither detonates in the cavitated 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 will be defined as self-reactive chemical TYPE F;

(g) Any self-reactive chemical which, in laboratory testing, neither detonates in the cavitated 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 (140 °F) to 75 °C (167 °F) for a 50 kg (110 lb) package), and, for liquid mixtures, a diluent having a boiling point greater than or equal to 150 °C (302 °F) is used for desensitization will be defined as self-reactive chemical TYPE G. If the mixture is not thermally stable or a diluent having a boiling point less than 150 °C (302 °F) is used for desensitization, the mixture shall be defined as self-reactive chemical TYPE F.

B.8.3 Additional Classification Considerations

B.8.3.1 For purposes of classification, the properties of self-reactive chemicals shall be determined in accordance with test series A to H as described in Part II of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6).

B.8.3.2 Self-accelerating decomposition temperature (SADT) shall be determined in accordance with the UN ST/SG/AC.10, Part II, section 28 (incorporated by reference; See § 1910.6).

B.8.3.3 The classification procedures for self-reactive substances and mixtures need not be applied if:

(a) There are no chemical groups present in the molecule associated with explosive or self-reactive properties; examples of such groups are given in Tables A6.1 and A6.2 in the Appendix 6 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6); or

(b) For a single organic substance or a homogeneous mixture of organic substances, the estimated SADT is greater than 75 °C (167 °F) or the exothermic decomposition energy is less than 300 J/g. The onset temperature and decomposition energy may be estimated using a suitable calorimetric technique (See 20.3.3.3 in Part II of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6)).

B.9 PYROPHORIC LIQUIDS

B.9.1 Definition

Pyrophoric liquid means a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

B.9.2 Classification Criteria

A pyrophoric liquid shall be classified in a single category for this class using test N.3 in Part III, sub-section 33.3.1.5 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.9.1:

TABLE B.9.1—CRITERIA FOR PYROPHORIC LIQUIDS

Category	Criteria
1	The liquid ignites within 5 min when added to an inert carrier and exposed to air, or it ignites or chars a filter paper on contact with air within 5 min.

B.9.3 Additional Classification Considerations

The classification procedure for pyrophoric liquids need not be applied when experience in production or handling shows that the chemical does not ignite spontaneously on coming into contact with air at normal temperatures (i.e., the substance is known to be stable at room temperature for prolonged periods of time (days)).

B.10 PYROPHORIC SOLIDS

B.10.1 Definition

Pyrophoric solid means a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

B.10.2 Classification Criteria

A pyrophoric solid shall be classified in a single category for this class using test N.2 in Part III, sub-section 33.3.1.4 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.10.1:

TABLE B.10.1—CRITERIA FOR PYROPHORIC SOLIDS

Category	Criteria
1	The solid ignites within 5 min of coming into contact with air.

Note: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.10.3 Additional Classification Considerations

The classification procedure for pyrophoric solids need not be applied when experience in production or handling shows that the chemical does not ignite spontaneously on coming into contact with air at normal temperatures (i.e., the chemical is known to be stable at room temperature for prolonged periods of time (days)).

B.11 SELF-HEATING CHEMICALS

B.11.1 Definition

A *self-heating chemical* is a solid or liquid chemical, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat; this chemical differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

Note: Self-heating of a substance or mixture is a process where the gradual reaction of that substance or mixture with oxygen (in air) generates heat. If the rate of heat production exceeds the rate of heat loss, then the temperature of the substance or mixture will rise which, after an induction time, may lead to self-ignition and combustion.

B.11.2 Classification Criteria

B.11.2.1 A self-heating chemical shall be classified in one of the two categories for this class if, in tests performed in accordance with test method N.4 in Part III, sub-section 33.3.1.6 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), the result meets the criteria shown in Table B.11.1.

TABLE B.11.1—CRITERIA FOR SELF-HEATING CHEMICALS

Category	Criteria
1	A positive result is obtained in a test using a 25 mm sample cube at 140 °C (284 °F).
2	A negative result is obtained in a test using a 25 mm cube sample at 140 °C (284 °F), a positive result is obtained in a test using a 100 mm sample cube at 140 °C (284 °F), and: (a) The unit volume of the chemical is more than 3 m^3; or (b) A positive result is obtained in a test using a 100 mm cube sample at 120 °C (248 °F) and the unit volume of the chemical is more than 450 liters; or (c) A positive result is obtained in a test using a 100 mm cube sample at 100 °C (212 °F).

B.11.2.2 Chemicals with a temperature of spontaneous combustion higher than 50 °C (122 °F) for a volume of 27 m^3 shall not be classified as self-heating chemicals.

B.11.2.3 Chemicals with a spontaneous ignition temperature higher than 50 °C (122 °F) for a volume of 450 liters shall not be classified in Category 1 of this class.

B.11.3 Additional Classification Considerations

B.11.3.1 The classification procedure for self-heating chemicals need not be applied if the results of a screening test can be adequately correlated with the classification test and an appropriate safety margin is applied.

B.11.3.2 Examples of screening tests are:

(a) The Grewer Oven test (VDI guideline 2263, part 1, 1990, Test methods for the Determination of the Safety Characteristics of Dusts) with an onset temperature 80°K above the reference temperature for a volume of 1 *l*;

(b) The Bulk Powder Screening Test (Gibson, N. Harper, D. J. Rogers, R. Evaluation of the fire and explosion risks in drying powders, Plant Operations Progress, 4 (3), 181–189, 1985) with an onset temperature 60°K above the reference temperature for a volume of 1 *l*.

B.12 CHEMICALS WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

B.12.1 Definition

Chemicals which, in contact with water, emit flammable gases are solid or liquid chemicals which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

B.12.2 Classification Criteria

B.12.2.1 A chemical which, in contact with water, emits flammable gases shall be classified in one of the three categories for this class, using test N.5 in Part III, sub-section 33.4.1.4 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.12.1:

TABLE B.12.1—CRITERIA FOR CHEMICALS WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

Category	Criteria
1	Any chemical which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 liters per kilogram of chemical over any one minute.
2	Any chemical which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 liters per kilogram of chemical per hour, and which does not meet the criteria for Category 1.
3	Any chemical which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 1 liter per kilogram of chemical per hour, and which does not meet the criteria for Categories 1 and 2.

Note: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.12.2.2 A chemical is classified as a chemical which, in contact with water emits flammable gases if spontaneous ignition takes place in any step of the test procedure.

B.12.3 Additional Classification Considerations

The classification procedure for this class need not be applied if:

(a) The chemical structure of the chemical does not contain metals or metalloids;

(b) Experience in production or handling shows that the chemical does not react with water, (e.g., the chemical is manufactured with water or washed with water); or

(c) The chemical is known to be soluble in water to form a stable mixture.

B.13 OXIDIZING LIQUIDS

B.13.1 Definition

Oxidizing liquid means a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

B.13.2 Classification Criteria

An oxidizing liquid shall be classified in one of the three categories for this class using test O.2 in Part III, sub-section 34.4.2 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.13.1:

TABLE B.13.1—CRITERIA FOR OXIDIZING LIQUIDS

Category	Criteria
1	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of chemical and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose;

TABLE B.13.1—CRITERIA FOR OXIDIZING LIQUIDS—Continued

Category	Criteria
2	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for Category 1 are not met;
3	Any chemical which, in the 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for Categories 1 and 2 are not met.

B.13.3 Additional Classification Considerations

B.13.3.1 For organic chemicals, the classification procedure for this class shall not be applied if:

(a) The chemical does not contain oxygen, fluorine or chlorine; or

(b) The chemical contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

B.13.3.2 For inorganic chemicals, the classification procedure for this class shall not be applied if the chemical does not contain oxygen or halogen atoms.

B.13.3.3 In the event of divergence between test results and known experience in the handling and use of chemicals which shows them to be oxidizing, judgments based on known experience shall take precedence over test results.

B.13.3.4 In cases where chemicals generate a pressure rise (too high or too low), caused by chemical reactions not characterizing the oxidizing properties of the chemical, the test described in Part III, sub-section 34.4.2 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6) shall be repeated with an inert substance (e.g., diatomite (kieselguhr)) in place of the cellulose in order to clarify the nature of the reaction.

B.14 OXIDIZING SOLIDS

B.14.1 Definition

Oxidizing solid means a solid which, while in itself is not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

B.14.2 Classification Criteria

An oxidizing solid shall be classified in one of the three categories for this class using test O.1 in Part III, sub-section 34.4.1 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.14.1:

TABLE B.14.1—CRITERIA FOR OXIDIZING SOLIDS

Category	Criteria
1	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose.
2	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for Category 1 are not met.
3	Any chemical which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for Categories 1 and 2 are not met.

Note 1: Some oxidizing solids may present explosion hazards under certain conditions (e.g., when stored in large quantities). For example, some types of ammonium nitrate may give rise to an explosion hazard under extreme conditions and the "Resistance to detonation test" (IMO: Code of Safe Practice for Solid Bulk Cargoes, 2005, Annex 3, Test 5) may be used to assess this hazard. When information indicates that an oxidizing solid may present an explosion hazard, it shall be indicated on the Safety Data Sheet.

Note 2: Classification of solid chemicals shall be based on tests performed on the chemical as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, classification must be based on testing of the chemical in the new form.

B.14.3 Additional Classification Considerations

B.14.3.1 For organic chemicals, the classification procedure for this class shall not be applied if:

(a) The chemical does not contain oxygen, fluorine or chlorine; or

(b) The chemical contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

B.14.3.2 For inorganic chemicals, the classification procedure for this class shall not be applied if the chemical does not contain oxygen or halogen atoms.

B.14.3.3 In the event of divergence between test results and known experience in the handling and use of chemicals which shows them to be oxidizing, judgements based on known experience shall take precedence over test results.

B.15 ORGANIC PEROXIDES

B.15.1 Definition

B.15.1.1 *Organic peroxide* means a liquid or solid organic chemical which contains the bivalent –0–0– structure and as such is considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term organic peroxide includes organic peroxide mixtures containing at least one organic peroxide. Organic peroxides are thermally unstable chemicals, which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties:

(a) Be liable to explosive decomposition;

(b) Burn rapidly;

(c) Be sensitive to impact or friction;

(d) React dangerously with other substances.

B.15.1.2 An organic peroxide is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

B.15.2 Classification Criteria

B.15.2.1 Any organic peroxide shall be considered for classification in this class, unless it contains:

(a) Not more than 1.0% available oxygen from the organic peroxides when containing not more than 1.0% hydrogen peroxide; or

(b) Not more than 0.5% available oxygen from the organic peroxides when containing more than 1.0% but not more than 7.0% hydrogen peroxide.

Note: The available oxygen content (%) of an organic peroxide mixture is given by the formula:

$$16 \times \sum_{i}^{n} \left(\frac{n_i \times c_i}{m_i} \right)$$

Where:

n_i = number of peroxygen groups per molecule of organic peroxide i;

c_i = concentration (mass %) of organic peroxide i;

m_i = molecular mass of organic peroxide i.

B.15.2.2 Organic peroxides shall be classified in one of the seven categories of "Types A to G" for this class, according to the following principles:

(a) Any organic peroxide which, as packaged, can detonate or deflagrate rapidly shall be defined as organic peroxide TYPE A;

(b) Any organic peroxide possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package shall be defined as organic peroxide TYPE B;

(c) Any organic peroxide possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion shall be defined as organic peroxide TYPE C;

(d) Any organic peroxide which in laboratory testing meets the criteria in (d)(i), (ii), or (iii) shall be defined as organic peroxide TYPE D:

(i) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or

(ii) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or

(iii) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement;

(e) Any organic peroxide which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement shall be defined as organic peroxide TYPE E;

(f) Any organic peroxide which, in laboratory testing, neither detonates in the cavitated 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 shall be defined as organic peroxide TYPE F;

(g) Any organic peroxide which, in laboratory testing, neither detonates in the cavitated 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 (140 °F) or higher for a 50 kg (110 lb) package), and, for liquid mixtures, a diluent having a boiling point of not less than 150 °C (302 °F) is used for desensitization, shall be defined as organic peroxide TYPE G. If the organic peroxide is not thermally stable or a diluent having a boiling point less than 150 °C (302 °F) is used for desensitization, it shall be defined as organic peroxide TYPE F.

B.15.3 Additional Classification Considerations

B.15.3.1 For purposes of classification, the properties of organic peroxides shall be determined in accordance with test series A to H as described in Part II of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6).

B.15.3.2 Self-accelerating decomposition temperature (SADT) shall be determined in accordance with the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), Part II, section 28.

B.15.3.3 Mixtures of organic peroxides may be classified as the same type of organic peroxide as that of the most dangerous ingredient. However, as two stable ingredients can form a thermally less stable mixture, the SADT of the mixture shall be determined.

B.16 CORROSIVE TO METALS

B.16.1 Definition

A *chemical which is corrosive to metals* means a chemical which by chemical action will materially damage, or even destroy, metals.

B.16.2 Classification Criteria

A chemical which is corrosive to metals shall be classified in a single category for this class, using the test in Part III, sub-section 37.4 of the UN ST/SG/AC.10 (incorporated by reference; See § 1910.6), in accordance with Table B.16.1:

TABLE B.16.1—CRITERIA FOR CHEMICALS CORROSIVE TO METAL

Category	Criteria
1	Corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm per year at a test temperature of 55 °C (131 °F) when tested on both materials.

Note: Where an initial test on either steel or aluminium indicates the chemical being tested is corrosive, the follow-up test on the other metal is not necessary.

B.16.3 Additional Classification Considerations

The specimen to be used for the test shall be made of the following materials:

(a) For the purposes of testing steel, steel types S235JR+CR (1.0037 resp.St 37–2), S275J2G3+CR (1.0144 resp.St 44–3), ISO 3574, Unified Numbering System (UNS) G 10200, or SAE 1020;

(b) For the purposes of testing aluminium: Non-clad types 7075–T6 or AZ5GU–T6.

APPENDIX C TO § 1910.1200—ALLOCATION OF LABEL ELEMENTS (MANDATORY)

C.1 The label for each hazardous chemical shall include the product identifier used on the safety data sheet.

C.1.1 The labels on shipped containers shall also include the name, address, and telephone number of the chemical manufacturer, importer, or responsible party.

C.2 The label for each hazardous chemical that is classified shall include the signal word, hazard statement(s), pictogram(s), and precautionary statement(s) specified in C.4 for each hazard class and associated hazard category, except as provided for in C.2.1 through C.2.4.

C.2.1 Precedence of Hazard Information

C.2.1.1 If the signal word "Danger" is included, the signal word "Warning" shall not appear;

C.2.1.2 If the skull and crossbones pictogram is included, the exclamation mark pictogram shall not appear where it is used for acute toxicity;

C.2.1.3 If the corrosive pictogram is included, the exclamation mark pictogram shall not appear where it is used for skin or eye irritation;

C.2.1.4 If the health hazard pictogram is included for respiratory sensitization, the exclamation mark pictogram shall not appear where it is used for skin sensitization or for skin or eye irritation.

C.2.2 Hazard Statement Text

C.2.2.1 The text of all applicable hazard statements shall appear on the label, except as otherwise specified. The information in italics shall be included as part of the hazard statement as provided. For example: "causes damage to organs *(state all organs affected)* through prolonged or repeated exposure *(state route of exposure if no other routes of exposure cause the hazard)*". Hazard statements may be combined where appropriate to reduce the information on the label and improve readability, as long as all of the hazards are conveyed as required.

C.2.2.2 If the chemical manufacturer, importer, or responsible party can demonstrate that all or part of the hazard statement is inappropriate to a specific substance or mixture, the corresponding statement may be omitted from the label.

C.2.3 Pictograms

C.2.3.1 Pictograms shall be in the shape of a square set at a point and shall include a black hazard symbol on a white background with a red frame sufficiently wide to be clearly visible. A square red frame set at a point without a hazard symbol is not a pictogram and is not permitted on the label.

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C.2.3.2 One of eight standard hazard symbols shall be used in each pictogram. The eight hazard symbols are depicted in Figure C.1. A pictogram using the exclamation mark symbol is presented in Figure C.2, for the purpose of illustration.

Figure C.1 – Hazard Symbols and Classes

Flame	Flame Over Circle	Exclamation Mark	Exploding Bomb
 Flammables Self Reactives Pyrophorics Self-heating Emits Flammable Gas Organic Peroxides	 Oxidizers	 Irritant Dermal Sensitizer Acute Toxicity (harmful) Narcotic Effects Respiratory Tract Irritation	 Explosives Self Reactives Organic Peroxides
Corrosion	**Gas Cylinder**	**Health Hazard**	**Skull and Crossbones**
 Corrosives	 Gases Under Pressure	 Carcinogen Respiratory Sensitizer Reproductive Toxicity Target Organ Toxicity Mutagenicity Aspiration Toxicity	 Acute Toxicity (severe)

Figure C.2 – Exclamation Mark Pictogram

C.2.3.3 Where a pictogram required by the Department of Transportation under Title 49 of the Code of Federal Regulations appears on a shipped container, the pictogram specified in C.4 for the same hazard shall not appear.

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C.2.4 Precautionary Statement Text

C.2.4.1 There are four types of precautionary statements presented, "prevention," "response," "storage," and "disposal." The core part of the precautionary statement is presented in bold print. This is the text, except as otherwise specified, that shall appear on the label. Where additional information is required, it is indicated in plain text.

C.2.4.2 When a backslash or diagonal mark (/) appears in the precautionary statement text, it indicates that a choice has to be made between the separated phrases. In such cases, the chemical manufacturer, importer, or responsible party can choose the most appropriate phrase(s). For example, "Wear protective gloves/protective clothing/eye protection/face protection" could read "wear eye protection".

C.2.4.3 When three full stops (* * *) appear in the precautionary statement text, they indicate that all applicable conditions are not listed. For example, in "Use explosion-proof electrical/ventilating/lighting/* * */equipment", the use of "* * *" indicates that other equipment may need to be specified. In such cases, the chemical manufacturer, importer, or responsible party can choose the other conditions to be specified.

C.2.4.4 When text *in italics* is used in a precautionary statement, this indicates specific conditions applying to the use or allocation of the precautionary statement. For example, "Use explosion-proof electrical/ventilating/lighting/* * */equipment" is only required for flammable solids "*if dust clouds can occur*". Text in italics is intended to be an explanatory, conditional note and is not intended to appear on the label.

C.2.4.5 Where square brackets ([ ]) appear around text in a precautionary statement, this indicates that the text in square brackets is not appropriate in every case and should be used only in certain circumstances. In these cases, conditions for use explaining when the text should be used are provided. For example, one precautionary statement states: "[In case of inadequate ventilation] wear respiratory protection." This statement is given with the condition for use "– text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use". This means that, if additional information is provided with the chemical explaining what type of ventilation would be adequate for safe use, the text in square brackets should be used and the statement would read: "In case of inadequate ventilation wear respiratory protection." However, if the chemical is supplied without such ventilation information, the text in square brackets should not be used, and the precautionary statement should read: "Wear respiratory protection."

C.2.4.6 Precautionary statements may be combined or consolidated to save label space and improve readability. For example, "Keep away from heat, sparks and open flame," "Store in a well-ventilated place" and "Keep cool" can be combined to read "Keep away from heat, sparks and open flame and store in a cool, well-ventilated place."

C.2.4.7 In most cases, the precautionary statements are independent (e.g., the phrases for explosive hazards do not modify those related to certain health hazards, and products that are classified for both hazard classes shall bear appropriate precautionary statements for both). Where a chemical is classified for a number of hazards, and the precautionary statements are similar, the most stringent shall be included on the label (this will be applicable mainly to preventive measures). An order of precedence may be imposed by the chemical manufacturer, importer or responsible party in situations where phrases concern "Response." Rapid action may be crucial. For example, if a chemical is carcinogenic and acutely toxic, rapid action may be crucial, and first aid measures for acute toxicity will take precedence over those for long-term effects. In addition, medical attention to delayed health effects may be required in cases of incidental exposure, even if not associated with immediate symptoms of intoxication.

C.2.4.8 If the chemical manufacturer, importer, or responsible party can demonstrate that a precautionary statement is inappropriate to a specific substance or mixture, the precautionary statement may be omitted from the label.

C.3 Supplementary Hazard Information

C.3.1 To ensure that non-standardized information does not lead to unnecessarily wide variation or undermine the required information, supplementary information on the label is limited to when it provides further detail and does not contradict or cast doubt on the validity of the standardized hazard information.

C.3.2 Where the chemical manufacturer, importer, or distributor chooses to add supplementary information on the label, the placement of supplemental information shall not impede identification of information required by this section.

C.3.3 Where an ingredient with unknown acute toxicity is used in a mixture at a concentration ≥1%, and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required on the label.

BILLING CODE 4510–26–P

C.4 REQUIREMENTS FOR SIGNAL WORDS, HAZARD STATEMENTS, PICTOGRAMS, AND PRECAUTIONARY STATEMENTS

C.4.1 ACUTE TOXICITY – ORAL
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
1	Danger	Fatal if swallowed
2	Danger	Fatal if swallowed

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash ...thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If swallowed: Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate administration of antidote is required.* **Rinse mouth.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.1 ACUTE TOXICITY – ORAL (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
3	Danger	Toxic if swallowed

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If swallowed: Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate administration of antidote is required*. **Rinse mouth.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.1 ACUTE TOXICITY – ORAL (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
4	Warning	Harmful if swallowed

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If swallowed: Call a poison center/doctor/.../ if you feel unwell.** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Rinse mouth.**		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.2 ACUTE TOXICITY - DERMAL
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
1	Danger	Fatal in contact with skin
2	Danger	Fatal in contact with skin

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not get in eyes, on skin, or on clothing. **Wash ... thoroughly after handling.** ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.** **Wear protective gloves/protective clothing.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Wash with plenty of water/...** ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. **Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate measures such as specific cleansing agent is advised.* **Take off immediately all contaminated clothing and wash it before reuse.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.2 ACUTE TOXICITY – DERMAL (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
3	Danger	Toxic in contact with skin

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wear protective gloves/protective clothing. Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Wash with plenty of water/...** ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. **Call a poison center/doctor/.../if you feel unwell.** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if measures such as specific cleansing agent is advised.* **Take off immediately all contaminated clothing and wash it before reuse.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.2 ACUTE TOXICITY – DERMAL (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
4	Warning	Harmful in contact with skin

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wear protective gloves/protective clothing Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Wash with plenty of water/...** ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. **Call a poison center/doctor/.../if you feel unwell.** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if measures such as specific cleansing agent is advised.* **Take off contaminated clothing and wash it before reuse.**		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.3 ACUTE TOXICITY - INHALATION
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
1	Danger	Fatal if inhaled
2	Danger	Fatal if inhaled

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Use only outdoors or in a well-ventilated area.** **[In case of inadequate ventilation] wear respiratory protection.** Chemical manufacturer, importer, or distributor to specify equipment. - *Text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use.*	**If inhaled: Remove person to fresh air and keep comfortable for breathing.** **Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment is urgent (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate administration of antidote is required.*	**Store in a well-ventilated place. Keep container tightly closed.** - *if product is volatile as to generate hazardous atmosphere.* **Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.3 ACUTE TOXICITY – INHALATION (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Skull and crossbones

Hazard category	Signal word	Hazard statement
3	Danger	Toxic if inhaled

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Use only outdoors or in a well-ventilated area.**	**If inhaled: Remove person to fresh air and keep comfortable for breathing.** **Call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate specific measures are required.*	**Store in a well-ventilated place. Keep container tightly closed.** - *if product is volatile so as to generate hazardous atmosphere.* **Store locked up.**	**Dispose of content/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.3 ACUTE TOXICITY – INHALATION (CONTINUED)
(Classified in Accordance with Appendix A.1)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
4	Warning	Harmful if inhaled

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Use only outdoors or in a well-ventilated area.**	**If inhaled: Remove person to fresh air and keep comfortable for breathing.** **Call a poison center/doctor/.../if you feel unwell.** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.		

C.4.4 SKIN CORROSION/IRRITATION
(Classified in Accordance with Appendix A.2)

Hazard category	Signal word	Hazard statement
1A to 1C	Danger	Causes severe skin burns and eye damage

Pictogram
Corrosion

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dusts or mists. - *if inhalable particles of dusts or mists may occur during use.* **Wash ...thoroughly after handling.** ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Wear protective gloves/protective clothing/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If swallowed: Rinse mouth. Do NOT induce vomiting.** **If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.** **Wash contaminated clothing before reuse.** **If inhaled: Remove person to fresh air and keep comfortable for breathing.** **Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *Manufacturer, importer, or distributor may specify a cleansing agent if appropriate.* **If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.4 SKIN CORROSION/IRRITATION (CONTINUED)
(Classified in Accordance with Appendix A.2)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
2	Warning	Causes skin irritation

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Wear protective gloves.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Wash with plenty of water/...** ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *Manufacturer, importer, or distributor may specify a cleansing agent if appropriate.* **If skin irritation occurs: Get medical advice/attention.** **Take off contaminated clothing and wash it before reuse.**		

C.4.5 EYE DAMAGE/IRRITATION
(Classified in Accordance with Appendix A.3)

Pictogram
Corrosion

Hazard category	Signal word	Hazard statement
1	Danger	Causes serious eye damage

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wear eye protection/face protection. Chemical manufacturer, importer, or distributor to specify type of equipment.	**If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.** **Immediately call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.		

C.4.5 EYE DAMAGE/IRRITATION (CONTINUED)
(Classified in Accordance with Appendix A.3)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
2A	Warning	Causes serious eye irritation

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash ... thoroughly after handling. ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Wear eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.** **If eye irritation persists: Get medical advice/attention.**		

C.4.5 EYE DAMAGE/IRRITATION (CONTINUED)
(Classified in Accordance with Appendix A.3)

Pictogram
No Pictogram

Hazard category	Signal word	Hazard statement
2B	Warning	Causes eye irritation

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wash … thoroughly after handling. … Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling.	**If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.** **If eye irritation persists: Get medical advice/attention.**		

C.4.6 SENSITIZATION - RESPIRATORY
(Classified in Accordance with Appendix A.4)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1 (including both sub-categories 1A and 1B)	Danger	May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **[In case of inadequate ventilation] wear respiratory protection.** Chemical manufacturer, importer, or distributor to specify equipment - *Text in square brackets may be used if additional information is provided with the chemical at the point of use that explains what type of ventilation would be adequate for safe use.*	**If inhaled: If breathing is difficult, remove person to fresh air and keep comfortable for breathing.** **If experiencing respiratory symptoms: Call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.7 SENSITIZATION - SKIN
(Classified in Accordance with Appendix A.4)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
1 (including both sub-categories 1A and 1B)	Warning	May cause an allergic skin reaction

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Avoid breathing dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Contaminated work clothing must not be allowed out of the workplace.** **Wear protective gloves.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Wash with plenty of water/...** ... Chemical manufacturer, importer, or distributor may specify a cleansing agent if appropriate, or may recommend an alternative agent in exceptional cases if water is clearly inappropriate. **If skin irritation or rash occurs: Get medical advice/attention.** **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *Manufacturer, importer, or distributor may specify a cleansing agent if appropriate.* **Wash contaminated clothing before reuse.**		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.8 GERM CELL MUTAGENICITY
(Classified in Accordance with Appendix A.5)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1A and 1B	Danger	May cause genetic defects <...>
2	Warning	Suspected of causing genetic defects <...>
		(state route of exposure if no other routes of exposure cause the hazard)

Precautionary statements

Prevention	Response	Storage	Disposal
Obtain special instructions before use. **Do not handle until all safety precautions have been read and understood.** **Wear protective gloves/protective clothing/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	**If exposed or concerned: Get medical advice/attention.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.9 CARCINOGENICITY
(Classified in Accordance with Appendix A.6)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1A and 1B	Danger	May cause cancer <...>
2	Warning	Suspected of causing cancer <...>
		(state route of exposure if no other routes of exposure cause the hazard)

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Obtain special instructions before use. **Do not handle until all safety precautions have been read and understood.** **Wear protective gloves/protective clothing/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	**If exposed or concerned: Get medical advice/attention.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

Note: If a Category 2 carcinogen ingredient is present in the mixture at a concentration between 0.1% and 1%, information is required on the SDS for a product; however, a label warning is optional. If a Category 2 carcinogen ingredient is present in the mixture at a concentration of ≥ 1%, both an SDS and a label is required and the information must be included on each.

C.4.10 TOXIC TO REPRODUCTION
(Classified in Accordance with Appendix A.7)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1A and 1B	Danger	May damage fertility or the unborn child <...> <<...>>
2	Warning	Suspected of damaging fertility or the unborn child <...> <<...>>
		(state specific effect if known)
		(state route of exposure if no other routes of exposure cause the hazard)

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Obtain special instructions before use. **Do not handle until all safety precautions have been read and understood.** **Wear protective gloves/protective clothing/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	**If exposed or concerned: Get medical advice/attention.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.10 TOXIC TO REPRODUCTION (CONTINUED)
(Classified in Accordance with Appendix A.7)
(EFFECTS ON OR VIA LACTATION)

Pictogram
No Pictogram

Hazard category	Signal word	Hazard statement
No designated number	*No signal word*	May cause harm to breast-fed children

(See Table A.7.1 in Appendix A.7)

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Obtain special instructions before use. **Do not breathe dusts or mists.** - *if inhalable particles of dusts or mists may occur during use.* **Avoid contact during pregnancy/while nursing.** **Wash ... thoroughly after handling.** ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If exposed or concerned: Get medical advice/attention.**		

C.4.11 SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (Classified in Accordance with Appendix A.8)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1	Danger	Causes damage to organs <...> <<...>> <...> *(or state all organs affected if known)* <<...>> *(state route of exposure if no other routes of exposure cause the hazard)*

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Wash ...thoroughly after handling.** ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If exposed: Call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Specific treatment (see ... on this label)** ... Reference to supplemental first aid instruction. - *if immediate measures are required.*	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.11 SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (CONTINUED)
(Classified in Accordance with Appendix A.8)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
2	Warning	May cause damage to organs <...> <<...>> <...> *(or state all organs affected, if known)* <<...>> *(state route of exposure if no other routes of exposure cause the hazard)*

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Wash ... thoroughly after handling.** ... Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**If exposed or concerned: Call a poison center/doctor/...** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.11 SPECIFIC TARGET ORGAN TOXICITY (Single Exposure) (CONTINUED)
(Classified in Accordance with Appendix A.8)

Pictogram
Exclamation mark

Hazard category	Signal word	Hazard statement
3	Warning	May cause respiratory irritation; or May cause drowsiness or dizziness

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Avoid breathing dust/fume/gas/mist/ vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Use only outdoors or in a well-ventilated area.**	**If inhaled: Remove person to fresh air and keep comfortable for breathing.** **Call a poison center/doctor/.../if you feel unwell.** ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice.	**Store in a well-ventilated place. Keep container tightly closed.** - *if product is volatile so as to generate hazardous atmosphere.* **Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.12 SPECIFIC TARGET ORGAN TOXICITY (Repeated Exposure) (Classified in Accordance with Appendix A.9)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1	Danger	Causes damage to organs <...> through prolonged or repeated exposure <<...>> <...> *(state all organs affected, if known)* <<...>> *(state route of exposure if no other routes of exposure cause the hazard)*

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions. **Wash ... thoroughly after handling.** ...Chemical manufacturer, importer, or distributor to specify parts of the body to be washed after handling. **Do not eat, drink or smoke when using this product.**	**Get medical advice/attention if you feel unwell.**		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.12 SPECIFIC TARGET ORGAN TOXICITY (Repeated Exposure) (CONTINUED)
(Classified in Accordance with Appendix A.9)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
2	Warning	May cause damage to organs <...> through prolonged or repeated exposure <<...>> <...> *(state all organs affected, if known)* <<...>> *(state route of exposure if no other routes of exposure cause the hazard)*

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Do not breathe dust/fume/gas/mist/vapors/spray. Chemical manufacturer, importer, or distributor to specify applicable conditions.	**Get medical advice/attention if you feel unwell.**		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.13 ASPIRATION HAZARD
(Classified in Accordance with Appendix A.10)

Pictogram
Health hazard

Hazard category	Signal word	Hazard statement
1	Danger	May be fatal if swallowed and enters airways

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
	If swallowed: Immediately call a poison center/doctor/... ... Chemical manufacturer, importer, or distributor to specify the appropriate source of emergency medical advice. **Do NOT induce vomiting.**	**Store locked up.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.14 EXPLOSIVES
(Classified in Accordance with Appendix B.1)

Pictogram
Exploding bomb

Hazard category	Signal word	Hazard statement
Unstable explosive	Danger	Unstable explosive

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Obtain special instructions before use. **Do not handle until all safety precautions have been read and understood.** **Wear personal protective equipment/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment, as required.	**Explosion risk in case of fire.** **Do NOT fight fire when fire reaches explosives.** **Evacuate area.**	**Store ...** ...in accordance with local/regional/ national/international regulations (to be specified).	**Dispose of contents/container to ...** ...in accordance with local/regional/ national/international regulations (to be specified).

C.4.14 EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)

Pictogram
Exploding bomb

Hazard category	Signal word	Hazard statement
Division 1.1	Danger	Explosive; mass explosion hazard
Division 1.2	Danger	Explosive; severe projection hazard
Division 1.3	Danger	Explosive; fire, blast or projection hazard

Precautionary statements

Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep wetted with...** ... Chemical manufacturer, importer, or distributor to specify appropriate material. - *if drying out increases explosion hazard, except as needed for manufacturing or operating processes (e.g., nitrocellulose).* **Ground/bond container and receiving equipment.** - *if the explosive is electrostatically sensitive.* **Do not subject to grinding/shock/.../friction.** ...Chemical manufacturer, importer, or distributor to specify applicable rough handling. **Wear face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: evacuate area.** **Explosion risk in case of fire.** **Do NOT fight fire when fire reaches explosives.**	**Store ...** ...in accordance with local/regional/national/ international regulations (to be specified).	**Dispose of contents/container to ...** ... in accordance with local/ regional/national/ international regulations (to be specified).

Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.

C.4.14 EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)

Hazard category	Signal word	Hazard statement
Division 1.4	Warning	Fire or projection hazard

Pictogram
Exploding bomb[1]

Precautionary statements[1]			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Ground/bond container and receiving equipment.** - *if the explosive is electrostatically sensitive.* **Do not subject to grinding/shock/.../friction.** Chemical manufacturer, importer, or distributor to specify applicable rough handling. **Wear face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Evacuate area.** **Explosion risk in case of fire.** - *except if explosives are 1.4S ammunition and components thereof.* **Do NOT fight fire when fire reaches explosives.** **Fight fire with normal precautions from a reasonable distance** - *if explosives are 1.4S ammunition and components thereof.*	**Store ...** ...in accordance with local/regional/national/international regulations (to be specified).	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.[1]

[1] *Except no pictogram is required for explosives that are 1.4S small arms ammunition and components thereof. Labels for 1.4S small arms ammunition and components shall include appropriate precautionary statements.*

C.4.14 EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)

Pictogram
No pictogram

Hazard category	Signal word	Hazard statement
Division 1.5	Danger	May mass explode in fire

Precautionary statements

Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep wetted with...** ... Chemical manufacturer, importer, or distributor to specify appropriate material. - *if drying out increases explosion hazard, except as needed for manufacturing or operating processes (e.g., nitrocellulose).* **Ground/bond container and receiving equipment** - *if the explosive is electrostatically sensitive.* **Do not subject to grinding/shock/.../friction.** ...Chemical manufacturer, importer, or distributor to specify applicable rough handling. **Wear face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Evacuate area.** **Explosion risk in case of fire.** **Do NOT fight fire when fire reaches explosives.**	**Store ...** ...in accordance with local/regional/ national/international regulations (to be specified).	**Dispose of contents/container to ...** ... in accordance with local/regional/ national/international regulations (to be specified).

Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.

C.4.14 EXPLOSIVES (CONTINUED)
(Classified in Accordance with Appendix B.1)

Pictogram
No pictogram

Hazard category	Signal word	Hazard statement
Division 1.6	*No signal word*	*No hazard statement*

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
None assigned.	None assigned	None assigned	None assigned

Note: Unpackaged explosives or explosives repacked in packagings other than the original or similar packaging shall have the label elements assigned to Division 1.1 unless the hazard is shown to correspond to one of the hazard categories in Appendix B.1, in which case the corresponding symbol, signal word and/or the hazard statement shall be assigned.

C.4.15 FLAMMABLE GASES
(Classified in Accordance with Appendix B.2)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
1	Danger	Extremely flammable gas

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s).	**Leaking gas fire: Do not extinguish, unless leak can be stopped safely.** **Eliminate all ignition sources if safe to do so.**	**Store in well-ventilated place.**	

C.4.15 FLAMMABLE GASES (CONTINUED)
(Classified in Accordance with Appendix B.2)

Pictogram
No Pictogram

Hazard category	Signal word	Hazard statement
2	Warning	Flammable gas

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s).	**Leaking gas fire: Do not extinguish, unless leak can be stopped safely.** **Eliminate all ignition sources if safe to do so.**	**Store in well-ventilated place.**	

C.4.16 FLAMMABLE AEROSOLS
(Classified in Accordance with Appendix B.3)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
1	Danger	Extremely flammable aerosol
2	Warning	Flammable aerosol

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s). **Do not spray on an open flame or other ignition source.** **Pressurized container: Do not pierce or burn, even after use.**		**Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.**	

C.4.17 OXIDIZING GASES
(Classified in Accordance with Appendix B.4)

Pictogram
Flame over circle

Hazard category	Signal word	Hazard statement
1	Danger	May cause or intensify fire; oxidizer

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep/Store away from clothing/.../combustible materials. ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Keep reduction valves/valves and fittings free from oil and grease.**	**In case of fire: Stop leak if safe to do so.**	**Store in well-ventilated place.**	

C.4.18 GASES UNDER PRESSURE
(Classified in Accordance with Appendix B.5)

Pictogram
Gas cylinder

Hazard category	Signal word	Hazard statement
Compressed gas	Warning	Contains gas under pressure; may explode if heated
Liquefied gas	Warning	Contains gas under pressure; may explode if heated
Dissolved gas	Warning	Contains gas under pressure; may explode if heated

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
		Protect from sunlight. Store in a well-ventilated place.	

C.4.18 GASES UNDER PRESSURE (CONTINUED)
(Classified in Accordance with Appendix B.5)

Pictogram
Gas cylinder

Hazard category	Signal word	Hazard statement
Refrigerated liquefied gas	Warning	Contains refrigerated gas; may cause cryogenic burns or injury

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Wear cold insulating gloves/face shield/eye protection.	**Thaw frosted parts with lukewarm water. Do not rub affected area.** **Get immediate medical advice/attention**	**Store in well-ventilated place.**	

C.4.19 FLAMMABLE LIQUIDS
(Classified in Accordance with Appendix B.6)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
1	Danger	Extremely flammable liquid and vapor
2	Danger	Highly flammable liquid and vapor
3	Warning	Flammable liquid and vapor

Precautionary statements

Prevention	Response	Storage	Disposal
Keep away from heat/sparks/open flames/hot surfaces.– No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep container tightly closed.** **Ground/Bond container and receiving equipment** - *if electrostatically sensitive material is for reloading.* - *if product is volatile so as to generate hazardous atmosphere.* **Use explosion-proof electrical/ventilating/ lighting/.../equipment.** ... Chemical manufacturer, importer, or distributor to specify other equipment. **Use only non-sparking tools.** **Take precautionary measures against static discharge.** **Wear protective gloves/eye protection/face protection** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.** **In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store in a well-ventilated place. Keep cool.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/ international regulations (to be specified).

C.4.19 FLAMMABLE LIQUIDS (CONTINUED)
(Classified in Accordance with Appendix B.6)

Pictogram
No Pictogram

Hazard category	Signal word	Hazard statement
4	Warning	Combustible liquid

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from flames and hot surfaces. – No smoking. **Wear protective gloves/eye protection/face protection** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store in a well-ventilated place. Keep cool.**	**Dispose of contents/container to...** in accordance with local/regional/ national/international regulations (to be specified).

C.4.20 FLAMMABLE SOLIDS
(Classified in Accordance with Appendix B.7)

Hazard category	Signal word	Hazard statement
1	Danger	Flammable solid
2	Warning	Flammable solid

Pictogram
Flame

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Ground/Bond container and receiving equipment.** - *if electrostatically sensitive material is for reloading*. **Use explosion-proof electrical/ventilating/ lighting/... /equipment.** ... Chemical manufacturer, importer, or distributor to specify other equipment. - *if dust clouds can occur*. **Wear protective gloves/eye protection/face protection** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk*.		

C.4.21 SELF-REACTIVE SUBSTANCES AND MIXTURES (Classified in Accordance with Appendix B.8)

Pictogram
Exploding bomb

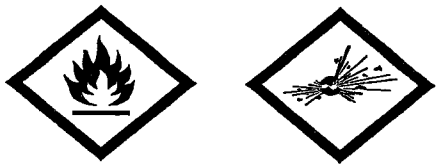
Hazard category	Signal word	Hazard statement
Type A	Danger	Heating may cause an explosion

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep/Store away from clothing/.../combustible materials.** ... Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.* **In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.**	**Store in a well-ventilated place. Keep cool.** **Store at temperatures not exceeding ...°C/...°F.** ... Chemical manufacturer, importer, or distributor to specify temperature. **Store away from other materials.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.21 SELF-REACTIVE SUBSTANCES AND MIXTURES (CONTINUED)
(Classified in Accordance with Appendix B.8)

Hazard category	Signal word	Hazard statement
Type B	Danger	Heating may cause a fire or explosion

Pictograms
Exploding bomb and flame



Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep/Store away from clothing/.../combustible materials.** ... Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk*. **In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.**	**Store in a well-ventilated place. Keep cool.** **Store at temperatures not exceeding ...°C/...°F.** ... Chemical manufacturer, importer, or distributor to specify temperature. **Store away from other materials.**	**Dispose of contents/container to...** ...in accordance with local/regional/national/international regulations (to be specified).

C.4.21 SELF-REACTIVE SUBSTANCES AND MIXTURES(CONTINUED)
(Classified in Accordance with Appendix B.8)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
Type C	Danger	Heating may cause a fire
Type D	Danger	Heating may cause a fire
Type E	Warning	Heating may cause a fire
Type F	Warning	Heating may cause a fire

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep/Store away from clothing/.../combustible materials.** ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store in a well-ventilated place. Keep cool.** **Store at temperatures not exceeding ...°C/...°F.** ...Chemical manufacturer, importer, or distributor to specify temperature. **Store away from other materials.**	**Dispose of contents/container to...** ...in accordance with local/regional/national/international regulations (to be specified).

C.4.22 PYROPHORIC LIQUIDS
(Classified in Accordance with Appendix B.9)

Hazard category	Signal word	Hazard statement
1	Danger	Catches fire spontaneously if exposed to air

Pictogram
Flame

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition sources(s). **Do not allow contact with air.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**If on skin: Immerse in cool water/wrap with wet bandages** **In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store contents under ...** ... Chemical manufacturer, importer, or distributor to specify appropriate liquid or inert gas.	

C.4.23 PYROPHORIC SOLIDS
(Classified in Accordance with Appendix B.10)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
1	Danger	Catches fire spontaneously if exposed to air

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Do not allow contact with air.** **Wear protective gloves/eye protection/face protection** Chemical manufacturer, importer, or distributor to specify type of equipment.	**Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages.** **In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk*.	**Store contents under ...** ...Chemical manufacturer, importer, or distributor to specify appropriate liquid or inert gas.	

C.4.24 SELF-HEATING SUBSTANCES AND MIXTURES (Classified in Accordance with Appendix B.11)

Hazard category	Signal word	Hazard statement
1	Danger	Self-heating; may catch fire
2	Warning	Self-heating in large quantities; may catch fire

Pictogram
Flame

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep cool. Protect from sunlight. **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.		**Maintain air gap between stacks/pallets.** **Store bulk masses greater than … kg/…lbs at temperatures not exceeding …°C/…°F.** … Chemical manufacturer, importer, or distributor to specify mass and temperature. **Store away from other materials.**	

C.4.25 SUBSTANCES AND MIXTURES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES (Classified in Accordance with Appendix B.12)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
1	Danger	In contact with water releases flammable gases, which may ignite spontaneously
2	Danger	In contact with water releases flammable gas

Precautionary statements

Prevention	Response	Storage	Disposal
Do not allow contact with water. **Handle under inert gas. Protect from moisture.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**Brush off loose particles from skin and immerse in cool water/wrap in wet bandages.** **In case of fire: Use ... to extinguish** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store in a dry place. Store in a closed container.**	**Dispose of contents/container to...** ...in accordance with local/regional/national/ international regulations (to be specified).

C.4.25 SUBSTANCES AND MIXTURES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES (CONTINUED)

(Classified in Accordance with Appendix B.12)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
3	Warning	In contact with water releases flammable gas

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Handle under inert gas. Protect from moisture. **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*	**Store in a dry place. Store in a closed container.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.26 OXIDIZING LIQUIDS
(Classified in Accordance with Appendix B.13)

Pictogram
Flame over circle

Hazard category	Signal word	Hazard statement
1	Danger	May cause fire or explosion; strong oxidizer

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat. **Keep/Store away from clothing and other combustible materials.** **Take any precaution to avoid mixing with combustibles/...** ... Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Wear protective gloves /eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment. **Wear fire/flame resistant/retardant clothing.**	**If on clothing: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.** **In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.** **In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*		**Dispose of contents/container to...** ...in accordance with local/regional/ national/international regulations (to be specified).

C.4.26 OXIDIZING LIQUIDS (CONTINUED)
(Classified in Accordance with Appendix B.13)

Pictogram
Flame over circle

Hazard category	Signal word	Hazard statement
2	Danger	May intensify fire; oxidizer
3	Warning	May intensify fire; oxidizer

Precautionary statements

Prevention	Response	Storage	Disposal
Keep away from heat. **Keep/Store away from clothing/.../combustible materials.** ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Take any precaution to avoid mixing with combustibles/...** ... Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk*.		**Dispose of contents/container to...** ...in accordance with local/regional/ national/international regulations (to be specified).

C.4.27 OXIDIZING SOLIDS
(Classified in Accordance with Appendix B.14)

Pictogram
Flame over circle

Hazard category	Signal word	Hazard statement
1	Danger	May cause fire or explosion; strong oxidizer

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat. **Keep away from clothing and other combustible materials.** **Take any precaution to avoid mixing with combustibles/...** ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment. **Wear fire/flame resistant/retardant clothing.**	**If on clothing: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.** **In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.** **In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*		**Dispose of contents/container to...** ...in accordance with local/regional/ national/international regulations (to be specified).

C.4.27 OXIDIZING SOLIDS (CONTINUED)
(Classified in Accordance with Appendix B.14)

Pictogram
Flame over circle

Hazard category	Signal word	Hazard statement
2	Danger	May intensify fire; oxidizer
3	Warning	May intensify fire; oxidizer

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat. **Keep/Store away from clothing/.../ combustible materials.** ... Chemical manufacturer, importer, or distributor to specify incompatible materials. **Take any precaution to avoid mixing with combustibles/...** ...Chemical manufacturer, importer, or distributor to specify other incompatible materials. **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.	**In case of fire: Use ... to extinguish.** ... Chemical manufacturer, importer, or distributor to specify appropriate media. - *if water increases risk.*		**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.28 ORGANIC PEROXIDES
(Classified in Accordance with Appendix B.15)

Pictogram
Exploding bomb

Hazard category	Signal word	Hazard statement
Type A	Danger	Heating may cause an explosion

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces.- No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep/Store away from clothing/.../combustible materials.** ... Chemical manufacturer, importer, or distributor to specify incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.		**Store at temperatures not exceeding ...°C/...°F. Keep cool.** ... Chemical manufacturer, importer, or distributor to specify temperature. **Protect from sunlight.** **Store away from other materials.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.28 ORGANIC PEROXIDES (CONTINUED)
(Classified in Accordance with Appendix B.15)

Hazard category	Signal word	Hazard statement
Type B	Danger	Heating may cause a fire or explosion

Pictograms

Exploding bomb and flame

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep /Store away from clothing/.../combustible materials.** ... Chemical manufacturer, importer, or distributor to specify incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.		**Store at temperatures not exceeding ...°C/...°F. Keep cool.** Chemical manufacturer, importer, or distributor to specify temperature. **Protect from sunlight.** **Store away from other materials.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.28 ORGANIC PEROXIDES (CONTINUED)
(Classified in Accordance with Appendix B.15)

Pictogram
Flame

Hazard category	Signal word	Hazard statement
Type C	Danger	Heating may cause a fire
Type D	Danger	Heating may cause a fire
Type E	Warning	Heating may cause a fire
Type F	Warning	Heating may cause a fire

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Chemical manufacturer, importer, or distributor to specify applicable ignition source(s). **Keep/Store away from clothing/.../ combustible materials** ... Chemical manufacturer, importer, or distributor to specify incompatible materials. **Keep only in original container.** **Wear protective gloves/eye protection/face protection.** Chemical manufacturer, importer, or distributor to specify type of equipment.		**Store at temperatures not exceeding ...°C/...°F. Keep cool.** ... Chemical manufacturer, importer, or distributor to specify temperature. **Protect from sunlight.** **Store away from other materials.**	**Dispose of contents/container to...** ... in accordance with local/regional/national/international regulations (to be specified).

C.4.29 CORROSIVE TO METALS
(Classified in Accordance with Appendix B.16)

Pictogram
Corrosion

Hazard category	Signal word	Hazard statement
1	Warning	May be corrosive to metals

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
Keep only in original container.	**Absorb spillage to prevent material damage.**	**Store in corrosive resistant/... container with a resistant inner liner.** ... Chemical manufacturer, importer, or distributor to specify other compatible materials.	

C.4.30 Label elements for OSHA defined hazards

Hazard	Signal word	Hazard statement	Pictogram
Pyrophoric Gas	Danger	Catches fire spontaneously if exposed to air	Flame
Simple Asphyxiant	Warning	May displace oxygen and cause rapid suffocation	*No Pictogram*
Combustible Dust[2]	Warning	May form combustible dust concentrations in air	*No Pictogram*

[2] *The chemical manufacturer or importer shall label chemicals that are shipped in dust form, and present a combustible dust hazard in that form when used downstream, under paragraph (f)(1); 2) the chemical manufacturer or importer shipping chemicals that are in a form that is not yet a dust must provide a label to customers under paragraph (f)(4) if, under normal conditions of use, the chemicals are processed in a downstream workplace in such a way that they present a combustible dust hazard; and 3) the employer shall follow the workplace labeling requirements under paragraph (f)(6) where combustible dust hazards are present.*

BILLING CODE 4510–26–C

Appendix D to § 1910.1200—Safety Data Sheets (Mandatory)

A safety data sheet (SDS) shall include the information specified in Table D.1 under the section number and heading indicated for sections 1–11 and 16. If no relevant information is found for any given subheading within a section, the SDS shall clearly indicate that no applicable information is available. Sections 12–15 may be included in the SDS, but are not mandatory.

TABLE D.1—MINIMUM INFORMATION FOR AN SDS

Heading	Subheading
1. Identification	(a) Product identifier used on the label; (b) Other means of identification; (c) Recommended use of the chemical and restrictions on use; (d) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party; (e) Emergency phone number.
2. Hazard(s) identification	(a) Classification of the chemical in accordance with paragraph (d) of § 1910.1200; (b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of § 1910.1200. (Hazard symbols may be provided as graphical reproductions in black and white or the name of the symbol, e.g., flame, skull and crossbones); (c) Describe any hazards not otherwise classified that have been identified during the classification process; (d) Where an ingredient with unknown acute toxicity is used in a mixture at a concentration ≥1% and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required.
3. Composition/Information on ingredients	Except as provided for in paragraph (i) of § 1910.1200 on trade secrets: For Substances (a) Chemical name; (b) Common name and synonyms; (c) CAS number and other unique identifiers; (d) Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. For Mixtures In addition to the information required for substances: (a) The chemical name and concentration (exact percentage) or concentration ranges of all ingredients which are classified as health hazards in accordance with paragraph (d) of § 1910.1200 and (1) Are present above their cut-off/concentration limits; or (2) Present a health risk below the cut-off/concentration limits. (b) The concentration (exact percentage) shall be specified unless a trade secret claim is made in accordance with paragraph (i) of § 1910.1200, when there is batch-to-batch variability in the production of a mixture, or for a group of substantially similar mixtures (*See* A.0.5.1.2) with similar chemical composition. In these cases, concentration ranges may be used. For All Chemicals Where a Trade Secret is Claimed Where a trade secret is claimed in accordance with paragraph (i) of § 1910.1200, a statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.
4. First-aid measures	(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion; (b) Most important symptoms/effects, acute and delayed. (c) Indication of immediate medical attention and special treatment needed, if necessary.
5. Fire-fighting measures	(a) Suitable (and unsuitable) extinguishing media. (b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products). (c) Special protective equipment and precautions for fire-fighters.
6. Accidental release measures	(a) Personal precautions, protective equipment, and emergency procedures. (b) Methods and materials for containment and cleaning up.
7. Handling and storage	(a) Precautions for safe handling. (b) Conditions for safe storage, including any incompatibilities.
8. Exposure controls/personal protection	(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available. (b) Appropriate engineering controls. (c) Individual protection measures, such as personal protective equipment.
9. Physical and chemical properties	(a) Appearance (physical state, color, etc.); (b) Odor; (c) Odor threshold; (d) pH; (e) Melting point/freezing point; (f) Initial boiling point and boiling range; (g) Flash point; (h) Evaporation rate; (i) Flammability (solid, gas); (j) Upper/lower flammability or explosive limits;

TABLE D.1—MINIMUM INFORMATION FOR AN SDS—Continued

Heading	Subheading
	(k) Vapor pressure; (l) Vapor density; (m) Relative density; (n) Solubility(ies); (o) Partition coefficient: n-octanol/water; (p) Auto-ignition temperature; (q) Decomposition temperature; (r) Viscosity.
10. Stability and reactivity	(a) Reactivity; (b) Chemical stability; (c) Possibility of hazardous reactions; (d) Conditions to avoid (e.g., static discharge, shock, or vibration); (e) Incompatible materials; (f) Hazardous decomposition products.
11. Toxicological information	Description of the various toxicological (health) effects and the available data used to identify those effects, including: (a) Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); (b) Symptoms related to the physical, chemical and toxicological characteristics; (c) Delayed and immediate effects and also chronic effects from short- and long-term exposure; (d) Numerical measures of toxicity (such as acute toxicity estimates). (e) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA.
12. Ecological information (Non-mandatory)	(a) Ecotoxicity (aquatic and terrestrial, where available); (b) Persistence and degradability; (c) Bioaccumulative potential; (d) Mobility in soil; (e) Other adverse effects (such as hazardous to the ozone layer).
13. Disposal considerations (Non-mandatory)	Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.
14. Transport information (Non-mandatory)	(a) UN number; (b) UN proper shipping name; (c) Transport hazard class(es); (d) Packing group, if applicable; (e) Environmental hazards (e.g., Marine pollutant (Yes/No)); (f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code); (g) 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 (Non-mandatory)	Safety, health and environmental regulations specific for the product in question.
16. Other information, including date of preparation or last revision.	The date of preparation of the SDS or the last change to it.

Appendix F to § 1910.1200—Guidance for Hazard Classifications Re: Carcinogenicity (Non-Mandatory)

The mandatory criteria for classification of a chemical for carcinogenicity under HCS (§ 1910.1200) are found in Appendix A.6 to this section. This non-mandatory Appendix provides additional guidance on hazard classification for carcinogenicity. Part A of Appendix F includes background guidance provided by GHS based on the Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006). Part B provides IARC classification information. Part C provides background guidance from the National Toxicology Program (NTP) "Report on Carcinogens" (RoC), and Part D is a table that compares GHS carcinogen hazard categories to carcinogen classifications under IARC and NTP, allowing classifiers to be able to use information from IARC and NTP RoC carcinogen classifications to complete their classifications under the GHS, and thus the HCS.

Part A: Background Guidance [1]

As noted in Footnote 6 of Appendix A.6. to this section, the GHS includes as guidance for classifiers information taken from the Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006), providing guidance on the evaluation of the strength and evidence of carcinogenic risks to humans. This guidance also discusses some additional considerations in classification and an approach to analysis, rather than hard-and-fast rules. Part A is consistent with Appendix A.6, and should help in evaluating information to determine carcinogenicity.

Carcinogenicity in humans:

The evidence relevant to carcinogenicity from studies in humans is classified into one of the following categories:

(a) Sufficient evidence of carcinogenicity: A causal relationship has been established between exposure to the agent and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence.

(b) Limited evidence of carcinogenicity: A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

Carcinogenicity in experimental animals:

The evidence relevant to carcinogenicity in experimental animals is classified into one of the following categories:

[1] *The text of Appendix F, Part A, on the IARC Monographs, is paraphrased from the 2006 Preamble to the "Monographs on the Evaluation of Carcinogenic Risks to Humans"; the Classifier is referred to the full IARC Preamble for the complete text. The text is not part of the agreed GHS text on the harmonized system developed by the OECD Task Force-HCL.*

(a) Sufficient evidence of carcinogenicity: A causal relationship has been established between the agent and an increased incidence of malignant neoplasms or of an appropriate combination of benign and malignant neoplasms in two or more species of animals or two or more independent studies in one species carried out at different times or in different laboratories or under different protocols. An increased incidence of tumors in both sexes of a single species in a well-conducted study, ideally conducted under Good Laboratory Practices, can also provide sufficient evidence.

Exceptionally, a single study in one species and sex might be considered to provide sufficient evidence of carcinogenicity when malignant neoplasms occur to an unusual degree with regard to incidence, site, type of tumor or age at onset, or when there are strong findings of tumors at multiple sites.

(a) Limited evidence of carcinogenicity: The data suggest a carcinogenic effect but are limited for making a definitive evaluation because, e.g. the evidence of carcinogenicity is restricted to a single experiment; there are unresolved questions regarding the adequacy of the design, conduct or interpretation of the studies; the agent increases the incidence only of benign neoplasms or lesions of uncertain neoplastic potential; or the evidence of carcinogenicity is restricted to studies that demonstrate only promoting activity in a narrow range of tissues or organs.

Guidance on How To Consider Important Factors in Classification of Carcinogenicity (See Reference Section)

The weight of evidence analysis called for in GHS and the HCS (§ 1910.1200) is an integrative approach that considers important factors in determining carcinogenic potential along with the strength of evidence analysis. The IPCS "*Conceptual Framework for Evaluating a Mode of Action for Chemical Carcinogenesis*" (2001), International Life Sciences Institute (ILSI) "*Framework for Human Relevance Analysis of Information on Carcinogenic Modes of Action*" (Meek, *et al.*, 2003; Cohen *et al.*, 2003, 2004), and Preamble to the IARC Monographs (2006; Section B.6. (Scientific Review and Evaluation; Evaluation and Rationale)) provide a basis for systematic assessments that may be performed in a consistent fashion. The IPCS also convened a panel in 2004 to further develop and clarify the human relevance framework. However, the above documents are not intended to dictate answers, nor provide lists of criteria to be checked off.

Mode of Action

Various documents on carcinogen assessment all note that mode of action in and of itself, or consideration of comparative metabolism, should be evaluated on a case-by-case basis and are part of an analytic evaluative approach. One must look closely at any mode of action in animal experiments, taking into consideration comparative toxicokinetics/toxicodynamics between the animal test species and humans to determine the relevance of the results to humans. This may lead to the possibility of discounting very specific effects of certain types of substances. Life stage-dependent effects on cellular differentiation may also lead to qualitative differences between animals and humans. Only if a mode of action of tumor development is conclusively determined not to be operative in humans may the carcinogenic evidence for that tumor be discounted. However, a weight of evidence evaluation for a substance calls for any other tumorigenic activity to be evaluated, as well.

Responses in Multiple Animal Experiments

Positive responses in several species add to the weight of evidence that a substance is a carcinogen. Taking into account all of the factors listed in A.6.2.5.2 and more, such chemicals with positive outcomes in two or more species would be provisionally considered to be classified in GHS Category 1B until human relevance of animal results are assessed in their entirety. It should be noted, however, that positive results for one species in at least two independent studies, or a single positive study showing unusually strong evidence of malignancy may also lead to Category 1B.

Responses Are in One Sex or Both Sexes

Any case of gender-specific tumors should be evaluated in light of the total tumorigenic response to the substance observed at other sites (multi-site responses or incidence above background) in determining the carcinogenic potential of the substance.

If tumors are seen only in one sex of an animal species, the mode of action should be carefully evaluated to see if the response is consistent with the postulated mode of action. Effects seen only in one sex in a test species may be less convincing than effects seen in both sexes, unless there is a clear patho-physiological difference consistent with the mode of action to explain the single sex response.

Confounding Effects of Excessive Toxicity or Localized Effects

Tumors occurring only at excessive doses associated with severe toxicity generally have doubtful potential for carcinogenicity in humans. In addition, tumors occurring only at sites of contact and/or only at excessive doses need to be carefully evaluated for human relevance for carcinogenic hazard. For example, forestomach tumors, following administration by gavage of an irritating or corrosive, non-mutagenic chemical, may be of questionable relevance. However, such determinations must be evaluated carefully in justifying the carcinogenic potential for humans; any occurrence of other tumors at distant sites must also be considered.

Tumor Type, Reduced Tumor Latency

Unusual tumor types or tumors occurring with reduced latency may add to the weight of evidence for the carcinogenic potential of a substance, even if the tumors are not statistically significant.

Toxicokinetic behavior is normally assumed to be similar in animals and humans, at least from a qualitative perspective. On the other hand, certain tumor types in animals may be associated with toxicokinetics or toxicodynamics that are unique to the animal species tested and may not be predictive of carcinogenicity in humans. Very few such examples have been agreed internationally. However, one example is the lack of human relevance of kidney tumors in male rats associated with compounds causing α2u-globulin nephropathy (IARC, Scientific Publication N° 147 [2]). Even when a particular tumor type may be discounted, expert judgment must be used in assessing the total tumor profile in any animal experiment.

Part B: International Agency for Research on Cancer (IARC)[3]

IARC Carcinogen Classification Categories:

Group 1: The agent is *carcinogenic to humans*

This category is used when there is *sufficient evidence of carcinogenicity* in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than *sufficient* but there is *sufficient evidence of carcinogenicity* in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Group 2:

This category includes agents for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost *sufficient*, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals. Agents are assigned to either Group 2A (*probably carcinogenic to humans*) or Group 2B (*possibly carcinogenic to humans*) on the basis of epidemiological and experimental evidence of carcinogenicity and mechanistic and other relevant data. The terms *probably carcinogenic* and *possibly carcinogenic* have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with *probably carcinogenic* signifying a higher level of evidence than *possibly carcinogenic.*

Group 2A: The agent is *probably carcinogenic to human.*

This category is used when there is *limited evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals. In some cases, an agent may be classified in this category when there is *inadequate evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of *limited evidence of carcinogenicity* in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

[2] *While most international agencies do not consider kidney tumors coincident with α2u-globulin nephropathy to be a predictor of risk in humans, this view is not universally held. (See: Doi et al., 2007).*

[3] *Preamble of the International Agency for Research on Cancer (IARC) "Monographs on the Evaluation of Carcinogenic Risks to Humans" (2006).*

Group 2B: The agent is *possibly carcinogenic to humans.*

This category is used for agents for which there is *limited evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals. It may also be used when there is *inadequate evidence of carcinogenicity* in humans but there is *sufficient evidence of carcinogenicity* in experimental animals. In some instances, an agent for which there is *inadequate evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

Part C: National Toxicology Program (NTP), "Report on Carcinogens", Background Guidance

NTP Listing Criteria [4]*:*

The criteria for listing an agent, substance, mixture, or exposure circumstance in the Report on Carcinogens (RoC) are as follows:

Known To Be A Human Carcinogen: There is sufficient evidence of carcinogenicity from studies in humans [5] that indicates a causal relationship between exposure to the agent, substance, or mixture, and human cancer.

Reasonably Anticipated To Be A Human Carcinogen: There is limited evidence of carcinogenicity from studies in humans that indicates that a causal interpretation is credible, but that alternative explanations, such as chance, bias, or confounding factors, could not adequately be excluded,

or

there is sufficient evidence of carcinogenicity from studies in experimental animals that indicates there is an increased incidence of malignant and/or a combination of malignant and benign tumors in multiple species or at multiple tissue sites, or by multiple routes of exposure, or to an unusual degree with regard to incidence, site, or type of tumor, or age at onset,

or

there is less than sufficient evidence of carcinogenicity in humans or laboratory animals; however, the agent, substance, or mixture belongs to a well-defined, structurally-related class of substances whose members are listed in a previous Report on Carcinogens as either known to be a human carcinogen or reasonably anticipated to be a human carcinogen, or there is convincing relevant information that the agent acts through mechanisms indicating it would likely cause cancer in humans.

Conclusions regarding carcinogenicity in humans or experimental animals are based on scientific judgment, with consideration given to all relevant information. Relevant information includes, but is not limited to, dose response, route of exposure, chemical structure, metabolism, pharmacokinetics, sensitive sub-populations, genetic effects, or other data relating to mechanism of action or factors that may be unique to a given substance. For example, there may be substances for which there is evidence of carcinogenicity in laboratory animals, but there are compelling data indicating that the agent acts through mechanisms that do not operate in humans and would therefore not reasonably be anticipated to cause cancer in humans.

Part D: Table Relating Approximate Equivalences Among IARC, NTP RoC, and GHS Carcinogenicity Classifications

The following table may be used to perform hazard classifications for carcinogenicity under the HCS (§ 1910.1200). It relates the approximated GHS hazard categories for carcinogenicity to the classifications provided by IARC and NTP, as described in Parts B and C of this Appendix.

APPROXIMATE EQUIVALENCES AMONG CARCINOGEN CLASSIFICATION SCHEMES

IARC	GHS	NTP RoC
Group 1	Category 1A	Known.
Group 2A	Category 1B	Reasonably Anticipated.
Group 2B	Category 2	(See Note 1).

Note 1:

1. *Limited evidence of carcinogenicity from studies in humans (corresponding to IARC 2A/GHS 1B);*
2. *Sufficient evidence of carcinogenicity from studies in experimental animals (again, essentially corresponding to IARC 2A/GHS 1B);*
3. *Less than sufficient evidence of carcinogenicity in humans or laboratory animals; however:*

c. *The agent, substance, or mixture belongs to a well-defined, structurally-related class of substances whose members are listed in a previous RoC as either "Known" or "Reasonably Anticipated" to be a human carcinogen, or*

d. *There is convincing relevant information that the agent acts through mechanisms indicating it would likely cause cancer in humans.*

***References**

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* * * * *

■ 33. Amend § 1910.1450 as follows:

■ A. Remove the definitions of *Combustible liquid, Compressed gas, Explosive, Flammable, Flashpoint, Organic peroxide, Oxidizer, Unstable (reactive),* and *Water-reactive* from paragraph (b);

■ B. Revise the definitions of *Hazardous chemical, Physical hazard, and Reproductive toxins* in paragraph (b);

■ C. Add definitions of *Health hazard* and *Mutagen* in alphabetical order in paragraph (b);

[4] *See: http://ntp.niehs.nih.gov/go/15209.*

[5] *This evidence can include traditional cancer epidemiology studies, data from clinical studies, and/or data derived from the study of tissues or cells from humans exposed to the substance in question that can be useful for evaluating whether a relevant cancer mechanism is operating in people.*

■ D. In paragraphs (f)(3)(v), (h)(1) introductory text, (h)(1)(ii) and (h)(2)(iii), remove the phrases "Material Safety Data Sheets" and "material safety data sheets" and add in their place "safety data sheets";

■ E. In Appendix A to § 1910.1450, in the Table of Contents (item "G") remove "Material Safety Data Sheets" and add in its place "Safety Data Sheets";

■ F. In Appendix A to § 1910.1450, revise the heading "G. Material Safety Data Sheets" and revise the text following the heading.

The revisions read as follows:

§ 1910.1450 Occupational exposure to hazardous chemicals in laboratories.

* * * * *

(b) * * *

Hazardous chemical means any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§ 1910.1200).

Health hazard means a chemical that 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; carcinogenity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A of the Hazard Communication Standard (§ 1910.1200) and § 1910.1200(c) (definition of "simple asphyxiant").

* * * * *

Mutagen means chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (§ 1910.1200) shall be considered mutagens for purposes of this section.

* * * * *

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 (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in Appendix B of the Hazard Communication Standard (§ 1910.1200) and § 1910.1200(c) (definitions of "combustible dust" and "pyrophoric gas").

* * * * *

Reproductive toxins mean chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§ 1910.1200) shall be considered reproductive toxins for purposes of this section.

* * * * *

Appendix A to § 1910.1450—National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

* * * * *

G. Safety Data Sheets

Safety data sheets are presented in "Prudent Practices" for the chemicals listed below. (Asterisks denote that comprehensive safety data sheets are provided).

* * * * *

PART 1915—OCCUPATIONAL SAFETY AND HEALTH STANDARDS FOR SHIPYARD EMPLOYMENT

■ 34. Revise the authority citation for part 1915 to read as follows:

Authority: Section 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Sections. 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31160), 4–2010 (75 FR 55355), or 1–2012 (77 FR 3912), as applicable; 29 CFR Part 1911.

Section 1915.100 also issued under 49 U.S.C. 1801–1819 and 5 U.S.C. 553.

Sections 1915.120 and 1915.152 of 29 CFR also issued under 29 CFR part 1911.

Subpart Z—[Amended]

■ 35. Revise § 1915.1001 paragraphs (i)(3), (k)(7), and (k)(8) to read as follows:

§ 1915.1001 Asbestos.

* * * * *

(i) * * *

(3) The employer shall ensure that contaminated clothing is transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (k) of this section.

* * * * *

(k) * * *

(7) *Hazard communication.* (i) Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers. Where feasible, installed asbestos products shall contain a visible label.

(ii) *General.* The employer shall include asbestos in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of asbestos and safety data sheets, and is trained in accordance with the provisions of the HCS and paragraph (k)(9) of this section. The employer shall ensure that at least the following hazards are addressed: Cancer and lung effects.

(iii) *Labels.* (A) The employer shall ensure that labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers bear the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

(B)(*1*) Prior to June 1, 2015, employers may include the following information on raw materials, mixtures or labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers in lieu of the labeling requirements in paragraphs (k)(7)(ii) and (k)(7)(iii)(A) of this section:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

(*2*) Labels shall also contain a warning statement against breathing asbestos fibers.

(iv) The provisions for labels required in paragraph (k)(7) of this section do not apply where:

(A) Asbestos fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that, during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the permissible exposure limit and/or excursion limit will be released, or

(B) Asbestos is present in a product in concentrations less than 1.0 percent.

(8) *Signs.* (i) Warning signs that demarcate the regulated area shall be provided and displayed at each location where a regulated area is required to be established by paragraph (e) of this section. Signs shall be posted at such a distance from such a location that an

employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(ii) The warning signs required by this paragraph (k)(8) shall bear the following legend:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

(iii) In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA

(iv) The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by paragraph (k)(8) of this section. Means to ensure employee comprehension may include the use of foreign languages, pictographs, and graphics.

(v) When a building/vessel owner or employer identifies previously installed PACM and/or ACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain PACM and/or ACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs required by paragraph (k)(6) of this section may be posted in lieu of labels, so long as they contain information required for labeling. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs or labels can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

(vi) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(8)(ii) of this section:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

(vii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(8)(iii) of this section:

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

* * * * *

■ 36. Revise § 1915.1026 paragraphs (g)(2)(iv) and (j)(1), to read as follows;

§ 1915.1026 Chromium (VI).

* * * * *

(g) * * *

(2) * * *

(iv) The employer shall ensure that bags or containers of contaminated protective clothing or equipment that are removed from change rooms for laundering, cleaning, maintenance, or disposal are labeled in accordance with the requirements of the Hazard Communication Standard, § 1910.1200.

* * * * *

(j) * * *

(1) *Hazard communication.* The employer shall include chromium (VI) in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of chromium (VI) and safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (j)(2) of this section. The employer shall ensure that at least the following hazards are addressed: Cancer; skin sensitization; and eye irritation.

* * * * *

PART 1926—SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

Subpart D—[Amended]

■ 37. The authority citation for subpart D is revised to read as follows:

Authority: Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704); Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); and Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355), or 1–2012 (77 FR 3912) as applicable; and 29 CFR part 1911.

Sections 1926.58, 1926.59, 1926.60, and 1926.65 also issued under 5 U.S.C. 553 and 29 CFR part 1911.

Section 1926.61 also issued under 49 U.S.C. 1801–1819 and 6 U.S.C. 553.

Section 1926.62 also issued under section 1031 of the Housing and Community Development Act of 1992 (42 U.S.C. 4853).

Section 1926.65 also issued under section 126 of the Superfund Amendments and Reauthorization Act of 1986, as amended (reprinted at 29 U.S.C.A. 655 Note), and 5 U.S.C. 553.

■ 38. Revise § 1926.60 paragraphs (l)(1) and (l)(2) to read as follows:

§ 1926.60 Methylenedianiline.

* * * * *

(l) * * *

(1) *Hazard communication.* The employer shall include Methylenedianiline (MDA) in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of MDA and safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (l)(3) of this section. The employer shall ensure that at least the following hazards are addressed: Cancer; liver effects; and skin sensitization.

(2) *Signs and labels*— (i) *Signs.* (A) The employer shall post and maintain legible signs demarcating regulated areas and entrances or access-ways to regulated areas that bear the following legend:

DANGER
MDA
MAY CAUSE CANCER
CAUSES DAMAGE TO THE LIVER
RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING MAY BE REQUIRED IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(B) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (l)(2)(i)(A) of this section:

DANGER
MDA
MAY CAUSE CANCER
LIVER TOXIN
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING MAY BE REQUIRED TO BE WORN IN THIS AREA

(ii) *Labels.* (A) The employer shall ensure that labels or other appropriate forms of warning are provided for containers of MDA within the workplace. The labels shall comply with the requirements of § 1910.1200(f) and shall include at least the following information for pure MDA and mixtures containing MDA:

DANGER
CONTAINS MDA
MAY CAUSE CANCER
CAUSES DAMAGE TO THE LIVER

(B) Prior to June 1, 2015, employers may include the following information workplace labels in lieu of the labeling requirements in paragraph (l)(2)(ii)(A) of this section:

(*1*) For Pure MDA:

DANGER
CONTAINS MDA
MAY CAUSE CANCER
LIVER TOXIN

(*2*) For mixtures containing MDA:

DANGER
CONTAINS MDA
CONTAINS MATERIALS WHICH MAY CAUSE CANCER

LIVER TOXIN

* * * * *

■ 39. Amend § 1926.62 by revising paragraph (g)(2)(vii), the heading of paragraph (l), paragraph (l)(1)(i), and paragraph (m), and Appendix B to § 1926.62 section XI, to read as follows:

§ 1926.62 Lead.

* * * * *

(g) * * *

(2) * * *

(vii)(A) The employer shall ensure that the containers of contaminated protective clothing and equipment required by paragraph (g)(2)(v) of this section are labeled as follows:

DANGER: CLOTHING AND EQUIPMENT CONTAMINATED WITH LEAD. MAY DAMAGE FERTILITY OR THE UNBORN CHILD. CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM. DO NOT EAT, DRINK OR SMOKE WHEN HANDLING. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

(B) Prior to June 1, 2015, employers may include the following information on bags or containers of contaminated protective clothing and equipment required by paragraph (g)(2)(v) in lieu of the labeling requirements in paragraph (g)(2)(vii)(A) of this section:

Caution: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead contaminated wash water in accordance with applicable local, state, or federal regulations.

* * * * *

(l) *Communication of hazards.*

(1) * * *

(i) *Hazard communication.* The employer shall include lead in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of lead and safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (l) of this section. The employer shall ensure that at least the following hazards are addressed:

(A) Reproductive/developmental toxicity;

(B) Central nervous system effects;

(C) Kidney effects;

(D) Blood effects; and

(E) Acute toxicity effects.

* * * * *

(m) *Signs.*

(1) *General.*

(i) The employer shall post the following warning signs in each work area where an employee's exposure to lead is above the PEL.

DANGER
LEAD WORK AREA
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

(ii) The employer shall ensure that no statement appears on or near any sign required by this paragraph (m) that contradicts or detracts from the meaning of the required sign.

(iii) The employer shall ensure that signs required by this paragraph (m) are illuminated and cleaned as necessary so that the legend is readily visible.

(iv) The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this paragraph (m).

(v) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (m)(1)(i) of this section:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

* * * * *

Appendix B to § 1926.62—Employee Standard Summary

* * * * *

XI. Signs—Paragraph (M)

The standard requires that the following warning sign be posted in work areas when the exposure to lead is above the PEL:

DANGER
LEAD WORK AREA
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

Prior to June 1, 2016, employers may use the following legend in lieu of that specified above:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

* * * * *

■ 40. Revise § 1926.64 paragraphs (a)(1)(ii) introductory text, (a)(1)(ii)(B), and (d)(1)(vii), and the note following paragraph (d)(1)(vii), to read as follows:

§ 1926.64 Process safety management of highly hazardous chemicals.

* * * * *

(a) * * *

(1) * * *

(ii) A process which involves a Category 1 flammable gas (as defined in § 1910.1200(c)) or flammable liquid with a flashpoint below 100 °F (37.8 °C) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:

* * * * *

(B) Flammable liquids with a flashpoint below 100 °F (37.8 °C) stored in atmospheric tanks or transferred that are kept below their normal boiling point without benefit of chilling or refrigeration.

* * * * *

(d) * * *

(1) * * *

(vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.

Note to paragraph (d)(1): Safety data sheets meeting the requirements of § 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this paragraph (d)(1).

* * * * *

■ 41. Amend § 1926.65 paragraph (a)(3) by revising the definition of "Health hazard" to read as follows:

§ 1926.65 Hazardous waste operations and emergency response.

(a) * * *

(3) * * *

Health hazard means a chemical or a pathogen where acute or chronic health effects may occur in exposed employees. It also includes stress due to temperature extremes. The term *health hazard* includes chemicals that are classified in accordance with the Hazard Communication Standard, § 1910.1200, 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); aspiration toxicity or simple asphyxiant. (*See* Appendix A to § 1910.1200—Health Hazard Criteria (Mandatory) for the criteria for determining whether a chemical is classified as a health hazard.)

* * * * *

Subpart F—[Amended]

■ 42. Revise the authority citation for subpart F to read as follows:

Authority: Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704); Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736),1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (62 FR 50017), 5–2002 (67 FR 650008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355), or 1–2012

(77 FR 3912), as applicable; and 29 CFR part 1911.

* * * * *

■ 43. Amend § 1926.152 as follows:

■ A. Revise the section heading;

■ B. Remove the words "and combustible" from the first sentence in paragraph (a)(1), the heading of paragraph (b), and paragraphs (b)(2) introductory text, (b)(4)(viii), (h) introductory text, and (h)(1);

■ C. Remove the words "or combustible" wherever it appears in paragraphs (a)(2), (b)(1), (b)(4)(iii), (b)(5), and (c)(3);

■ D. Remove the words "or combustible" in paragraphs (d) (the heading), (d)(1), (d)(4), (e)(1), (e)(3), (f)(2), (g)(1), and (g)(8);

■ E. Remove the words "or combustible" wherever it appears in paragraphs (i)(1)(i)(D) and (F), (i)(1)(iii)(D), (i)(2)(ii)(A), (D), and (F), (i)(2)(vii)(B)(*2*), (i)(4)(iv)(C), (i)(5)(vi)(A), (D), (G), (V) introductory text, and (i)(5)(vi)(V)(*1*); (j)(1)(i), (j)(2)(ii), (j)(5), and (k)(4);

■ F. Amend the fifth sentence of paragraph (b)(4)(vi) by adding the words "Category 1, 2, or 3" before the words "flammable liquids";

■ G. Amend paragraphs (e)(2), (e)(5), (g)(7)(i), and (g)(7)(ii), by adding the words "Category 1, 2, or 3" before the words "flammable liquids" ;

■ H. Amend paragraphs (f)(1) and (f)(3) by removing the words "Flammable liquids" and adding in their place the words "Category 1, 2, or 3 flammable liquids";

■ I. Revise paragraphs (b)(2)(iii), (b)(3), (h) introductory text, (i)(2)(iv)(F) and (G), (i)(2)(vi)(B), (i)(2)(viii)(E), (i)(3)(i), (i)(3)(iv)(A) and (C), (i)(3)(v)(D), and (i)(4)(iv)(E);

■ J. Revise Table F–19 and paragraph (k)(3)(iv).

The revisions read as follows:

§ 1926.152 Flammable liquids.

* * * * *

(b) * * *

(2) * * *

(iii) Cabinets shall be labeled in conspicuous lettering, "Flammable-Keep Away from Open Flames."

(3) Not more than 60 gallons of Category 1, 2 and/or 3 flammable liquids or 120 gallons of Category 4 flammable liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room.

* * * * *

(h) *Scope.* This section applies to the handling, storage, and use of flammable liquids with a flashpoint at or below 199.4 °F (93 °C). This section does not apply to:

* * * * *

(i) * * *

(2) * * *

(iv) * * *

(F) Tanks and pressure vessels storing Category 1 flammable liquids shall be equipped with venting devices that shall be normally closed except when venting to pressure or vacuum conditions. Tanks and pressure vessels storing Category 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be equipped with venting devices that shall be normally closed except when venting under pressure or vacuum conditions, or with approved flame arresters.

Exemption: Tanks of 3,000 bbls (barrels) (84 m(3)) capacity or less containing crude petroleum in crude-producing areas; and, outside aboveground atmospheric tanks under 1,000 gallons (3,785 L) capacity containing other than Category 1 flammable liquids may have open vents. (*See* paragraph (i)(2)(vi)(B) of this section.)

(G) Flame arresters or venting devices required in paragraph (i)(2)(iv)(F) of this section may be omitted for Category 2 flammable liquids or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C) where conditions are such that their use may, in case of obstruction, result in tank damage.

* * * * *

(vi) * * *

(B) Where vent pipe outlets for tanks storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 feet (3.658 m) above the adjacent ground level. In order to aid their dispersion, vapors shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least 5 feet (1.52 m) from building openings.

(viii) * * *

(E) For Category 2 flammable liquids or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within 6 inches (15.24 cm) of the bottom of the tank and shall be installed to avoid excessive vibration.

* * * * *

(3) * * *

(i) *Location.* Evacuation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), to the nearest wall of any basement or pit shall be not less than 1 foot (0.304 m), and to any property line that may be built upon, not less than 3 feet (0.912 m). The distance from any part of a tank storing Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids to the nearest wall of any basement, pit or property line shall be not less than 1 foot (0.304 m).

* * * * *

(iv) * * *

(A) Location and arrangement of vents for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C). Vent pipes from tanks storing Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet (3.658 m) above the adjacent ground level. Vent pipes shall discharge only upward in order to disperse vapors. Vent pipes 2 inches (5.08 cm) or less in nominal inside diameter shall not be obstructed by devices that will cause excessive back pressure. Vent pipe outlets shall be so located that flammable vapors will not enter building openings, or be trapped under eaves or other obstructions. If the vent pipe is less than 10 feet (3.04 m) in length, or greater than 2 inches (5.08 cm) in nominal inside diameter, the outlet shall be provided with a vacuum and pressure relief device or there shall be an approved flame arrester located in the vent line at the outlet or within the approved distance from the outlet.

* * * * *

(C) Location and arrangement of vents for Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4 flammable liquids. Vent pipes from tanks storing Category 3 flammable liquids with a flashpoint at or above 100 °F (37.8 °C) or Category 4

flammable liquids shall terminate outside of the building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, coarse screens or other devices to minimize ingress of foreign material.

* * * * *

(v) * * *

(D) For Category 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 inches (15.24 cm) of the bottom of the tank.

* * * * *

(4) * * *

(iv) * * *

(E) For Category 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 inches (15.24 cm) of the bottom of the tank.

* * * * *

(k) * * *

(3) * * *

* * * * *

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TABLE F-19 - ELECTRICAL EQUIPMENT HAZARDOUS AREAS - SERVICE STATIONS

Location	Class I Group D division	Extent of classified area
Underground tank:		
Fill opening	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches (45.72 cm) above grade level within a horizontal radius of 10 feet (3.04 m) from a loose fill connection and within a horizontal radius of 5 feet (1.52 m) from a tight fill connection.
Vent - Discharging upward...	1	Within 3 feet (0.912 m) of open end of vent, extending in all directions.
	2	Area between 3 feet (0.912 m) and 5 feet (1.52 m) of open end of vent, extending in all directions.
Dispenser:		
Pits.....	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
Dispenser enclosure.....	1	The area 4 feet (1.216 m) vertically above base within the enclosure and 18 inches (45.72 cm) horizontally in all directions.
Outdoor.....	2	Up to 18 inches (45.72 cm) above grade level within 20 feet (6.08 m) horizontally of any edge of enclosure.
Indoor:		
With mechanical ventilation.	2	Up to 18 inches (45.72 cm) above grade level within 20 feet (6.08 m) horizontally of any edge of enclosure.
With gravity ventilation....	2	Up to 18 inches (45.72 cm) above grade or floor level within 25 feet (7.6 m) horizontally of any edge of enclosure.
Remote pump - Outdoor.....	1	Any pit, box or space below grade level if any part is within a horizontal distance of 10 feet (3.04 m) from any edge of pump.
	2	Within 3 feet (0.912 m) of any edge of pump, extending

		in all directions. Also up to 18 inches (45.72 cm) above grade level within 10 feet (3.04 m) horizontally from any edge of pump.
Remote pump - Indoor.....	1	Entire area within any pit.
	2	Within 5 feet (1.52 m) of any edge of pump, extending in all directions. Also up to 3 feet (3.04 m) above floor or grade level within 25 feet (6.08 m) horizontally from any edge of pump.
Lubrication or service room.	1	Entire area within any pit.
	2	Area up to 18 inches (45.72 cm) above floor or grade level within entire lubrication room.
Dispenser for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 ° F (37.8 ° C)	2	Within 3 feet (0.912 m) of any fill or dispensing point, extending in all directions.
Special enclosure inside building per 1910.106(f)(1)(ii).	1	Entire enclosure.
Sales, storage and rest rooms.....	(1)	If there is any opening to these rooms within the extent of a Division 1 area, the entire room shall be classified as Division 1.

(1) Ordinary.

* * * * *

BILLING CODE 4510–26–C

(iv) Piping handling Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be grounded to control stray currents.

* * * * *

■ 44. Amend § 1926.155 as follows:

■ A. Remove and reserve paragraph (c);

■ B. Revise paragraphs (h) and (i)(1) and (2).

The revisions read as follows:

§ 1926.155 Definitions applicable to this subpart.

* * * * *

(h) *Flammable liquid* means any liquid having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 °F (37.8 °C) and having a flashpoint at or below 199.4 °F (93 °C). Flammable liquids are divided into four categories as follows:

(1) Category 1 shall include liquids having flashpoints below 73.4 °F (23 °C) and having a boiling point at or below 95 °F (35 °C).

(2) Category 2 shall include liquids having flashpoints below 73.4 °F (23 °C) and having a boiling point above 95 °F (35 °C).

(3) Category 3 shall include liquids having flashpoints at or above 73.4 °F (23 °C) and at or below 140 °F (60 °C).

(4) Category 4 shall include liquids having flashpoints above 140 °F (60 °C) and at or below 199.4 °F (93 °C).

(i) * * *

(1) The flashpoint of liquids having a viscosity less than 45 Saybolt Universal Second(s) at 100 °F (37.8 °C) and a flashpoint below 175 °F (79.4 °C) shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D–56–69 (incorporated by reference; *See* § 1926.6), or an equivalent method as defined by § 1910.1200 appendix B.

(2) The flashpoints of liquids having a viscosity of 45 Saybolt Universal Second(s) or more at 175 °F (79.4 °C) or higher shall be determined in accordance with the Standard Method of Test for Flash Point by the Pensky Martens Closed Tester, ASTM D–93–69 (incorporated by reference; *See* § 1926.6), or an equivalent method as defined by § 1910.1200 appendix B.

* * * * *

Subpart Z—[Amended]

■ 45. Revise the authority citation for subpart Z to read as follows:

Authority: Section107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704); Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); and Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 6–96 (62 FR 111), 3–2000 (65 FR 50017), 5–2002 (67 FR 65008), 5–2007 (72 FR 31159), 4–2010 (75 FR 55355), or 1–2012 (77 FR 3912) as applicable; and 29 CFR part 1911.

Section 1926.1102 not issued under 29 U.S.C. 655 or 29 CFR part 1911; also issued under 5 U.S.C. 553.

■ 46. Amend § 1926.1101 as follows:

■ A. Redesignate paragraph (k)(1) as (k)(1)(i) and add a new heading to paragraph (k)(1);

■ B. Add new paragraphs (k)(1)(ii), (k)(7)(ii)(C), (k)(7)(ii)(D), and (k)(8)(iv);

■ C. Amend paragraphs (k)(2)(i) and (k)(3)(i) by removing the references to "(k)(1)" and adding in their place "(k)(1)(i)";

■ D. Revise paragraphs (k)(7)(ii)(A) and (B), and (k)(8)(ii) and (iii);

The revisions read as follows:

§ 1926.1101 Asbestos.

* * * * *

(k) * * *

(1) *Hazard communication.*

* * * * *

(ii) The employer shall include asbestos in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of asbestos and safety data sheets, and is trained in accordance with the provisions of HCS and paragraphs (k)(9) and (10) of this section. The employer shall provide information on at least the following hazards: Cancer and lung effects.

* * * * *

(7) * * *

(ii) * * *

(A) The warning signs required by paragraph (k)(7) of this section shall bear the following information.

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

(B) In addition, where the use of respirators and protective clothing is required in the regulated area under this section, the warning signs shall include the following:

WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA

(C) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(7)(ii)(A) of this section:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

(D) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (k)(7)(ii)(B) of this section:

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

* * * * *

(8) * * *

(ii) The employer shall ensure that such labels comply with paragraphs (k) of this section.

(iii) The employer shall ensure that labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers bear the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

(iv) (A) Prior to June 1, 2015, employers may include the following information on raw materials, mixtures or labels of bags or containers of protective clothing and equipment, scrap, waste, and debris containing asbestos fibers in lieu of the labeling requirements in paragraphs (k)(8)(ii) and (k)(8)(iii) of this section:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

(B) Labels shall also contain a warning statement against breathing asbestos fibers.

* * * * *

■ 47. Revise § 1926.1126 paragraphs (g)(2)(iv) and (j)(1) to read as follows:

§ 1926.1126 Chromium (VI).

* * * * *

(g) * * *

(2) * * *

(iv) The employer shall ensure that bags or containers of contaminated protective clothing or equipment that are removed from change rooms for laundering, cleaning, maintenance, or disposal shall be labeled in accordance with the requirements of the Hazard Communication Standard, § 1910.1200.

* * * * *

(j) * * *

(1) *Hazard communication.* The employer shall include chromium (VI) in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of chromium and safety data sheets, and is trained in accordance with the provisions of § 1910.1200 and paragraph (j)(2) of this section. The employer shall provide information on at least the following hazards: Cancer; eye irritation; and skin sensitization.

* * * * *

■ 48. Revise § 1926.1127 paragraphs (i)(2)(iv), (k)(7), and (m)(1), (m)(2), and (m)(3), to read as follows:

§ 1926.1127 Cadmium.

* * * * *

(i) * * *

(2) * * *

(iv) The employer shall ensure that containers of contaminated protective clothing and equipment that are to be taken out of the change rooms or the workplace for laundering, cleaning, maintenance or disposal shall bear labels in accordance with paragraph (m)(3)(ii) of this section.

(k) * * *

(7) Waste, scrap, debris, bags, and containers, personal protective equipment and clothing contaminated with cadmium and consigned for disposal shall be collected and disposed of in sealed impermeable bags or other closed, impermeable containers. These bags and containers shall be labeled in accordance with paragraph (m)(3)(ii) of this section.

* * * * *

(m) * * *

(1) *Hazard communication.* The employer shall include cadmium in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of cadmium and safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (m)(4) of this section. The employer shall provide information on at least the following hazards: Cancer; lung effects; kidney effects; and acute toxicity effects.

(2) *Warning signs.* (i) Warning signs shall be provided and displayed in regulated areas. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(ii) Warning signs required by paragraph (m)(2)(i) of this section shall bear the following legend:

DANGER
CADMIUM
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS AND KIDNEYS
WEAR RESPIRATORY PROTECTION IN THIS AREA
AUTHORIZED PERSONNEL ONLY

(iii) The employer shall ensure that signs required by this paragraph (m)(2) are illuminated, cleaned, and maintained as necessary so that the legend is readily visible.

(iv) Prior to June 1, 2016, employers may use the following legend in lieu of

that specified in paragraph (m)(2)(ii) of this section:

DANGER
CADMIUM
CANCER HAZARD
CAN CAUSE LUNG AND KIDNEY DISEASE
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN THIS AREA

(3) *Warning labels.* (i) Shipping and storage containers containing cadmium or cadmium compounds shall bear appropriate warning labels, as specified in paragraph (m)(1) of this section.

(ii) The warning labels for containers of cadmium-contaminated protective clothing, equipment, waste, scrap, or debris shall include at least the following information:

DANGER
CONTAINS CADMIUM
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS AND KIDNEYS
AVOID CREATING DUST

(iii) Where feasible, installed cadmium products shall have a visible label or other indication that cadmium is present.

(iv) Prior to June 1, 2015, employers may include the following information on shipping and storage containers containing cadmium, cadmium compounds, or cadmium-contaminated clothing, equipment, waste, scrap, or debris in lieu of the labeling requirements specified in paragraphs (m)(3)(i) and (m)(3)(ii) of this section:

DANGER
CONTAINS CADMIUM
CANCER HAZARD
AVOID CREATING DUST
CAN CAUSE LUNG AND KIDNEY DISEASE

* * * * *

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