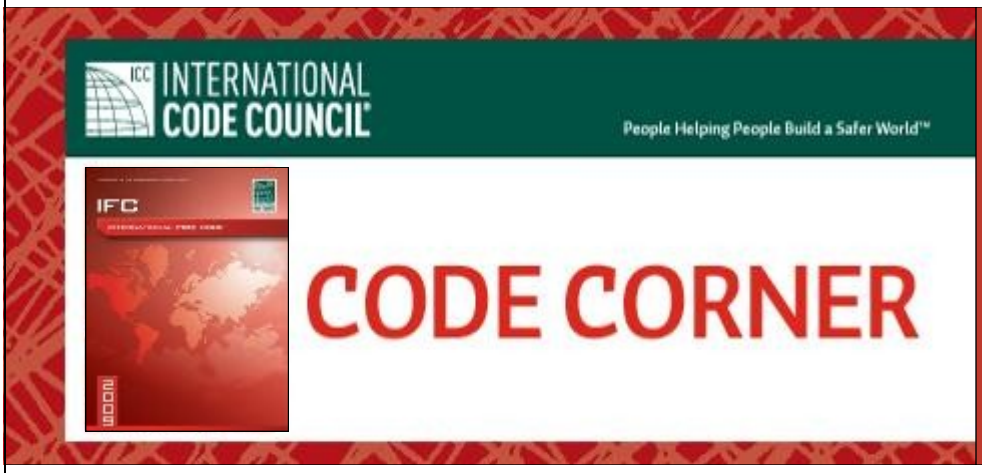

ABOUT CODE CORNER

CCFS would like to remind you to check with your local "Authority Having Jurisdiction (AHJ)" for questions and opinions concerning your local Fire and Building Codes. The information contained in this article is supplied as a courtesy by the International Code Council (ICC) and is based on the International Fire and Building Codes and their respective commentaries. Your local codes or ordinances may vary.

CHAPTER 37:
HIGHLY TOXIC AND TOXIC MATERIALS

General Comments

Toxic and highly toxic materials are addressed in the code because of the immediate threat they pose to occupants, others in the vicinity of a building and facility and emergency responders. As with other health hazard materials, the solid state is usually the least hazardous, while the gaseous form is the most hazardous. Materials are often listed as being toxic or highly toxic on Material Safety Data Sheets (MSDS). These descriptors do not necessarily mean that the materials would be considered toxic or highly toxic according to the specific definitions found in Section 3702. Those definitions provide specific criteria that will be discussed in more detail. Generally, the requirements for toxic and highly toxic materials are the most regulated health hazards in the code. This chapter deals with all three states of toxic and highly toxic materials: solids, liquids and gases. As will be discussed, gases will generally require treatment systems and related ventilation systems.

Purpose

The main purpose of this chapter is, as noted, to protect occupants, emergency responders and those in the immediate area of the building and facility from short-term, acute hazards associated with a release or general exposure to toxic and highly toxic materials. The code does not address long-term exposure effects. Such issues are addressed by agencies such as the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA).

SECTION 3701
GENERAL

3701.1 Scope. The storage and use of highly toxic and toxic materials shall comply with this chapter. *Compressed gases* shall also comply with Chapter 30.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 2703.11.

2. Conditions involving pesticides or agricultural products as follows:

2.1. Application and release of pesticide, agricultural products and materials intended for use in weed abatement, erosion control, soil amendment or similar applications when applied in accordance with the manufacturer's instruction and label directions.

2.2. Transportation of pesticides in compliance with the Federal Hazardous Materials Transportation Act and regulations there under.

2.3. Storage in *dwellings* or private garages of pesticides registered by the U.S. Environmental Protection Agency to be utilized in and around the home, garden, pool, spa and patio.

☿ *This section states that highly toxic materials must be stored and used in accordance with this chapter. Additionally, it notes that gases are subject to the requirements in Chapter 30, which focuses on the hazards associated with the fact that the material is a compressed gas.*

There are various exceptions to this chapter. Exception 1 is related to the increased amounts allowed for storage and display in Group M and S occupancies. These increased amounts apply only to solids and liquids. For this exception to apply, all requirements found in Section 2703.11 are applicable. Exception 2 is specific to pesticides or other agriculture-related products. Essentially, only storage in a building or facility would be regulated. The application, release or transportation of such materials would be exempt because federal standards would preempt a local jurisdiction from enforcement. In terms of application and release, regulations are specific to activities such as weed control, erosion control and soil amendment. Additionally, pesticides approved for use around homes, gardens, pools, spas and patios can be stored without regulation in private garages and within dwellings.

3701.2 Permits. Permits shall be required as set forth in Section 105.6.

☿ *The process of issuing permits gives the fire code official an opportunity to carefully evaluate and regulate hazardous operations. Permit applicants should be required to demonstrate that their operations comply with the intent of the code before the permit is issued. See the commentary to Section 105.6 for a general discussion of operations requiring an operational permit, Section 105.6.20 for a discussion of specific quantity- based operational permits for the materials regulated in this chapter and Section 105.7 for a general discussion of activities requiring a construction permit. The permit process also notifies the fire department of the need for prefire planning for hazardous property.*

SECTION 3702
DEFINITIONS

3702.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

☿ *Definitions of terms can help in the understanding and application of the code requirements. The purpose for including those definitions here that are most closely associated with the subject matter of this chapter is to provide more convenient access to them without having to refer back to Chapter 2. For convenience, these terms are also listed in Chapter 2 with a cross reference to this section. The use and application of all defined terms, including those defined in this section, are set forth in Section 201.*

CONTAINMENT SYSTEM. A gas-tight recovery system comprised of equipment or devices which can be placed over a leak in a *compressed gas* container, thereby stopping or controlling the escape of gas from the leaking container.

☿ *A containment system consists of various components that will capture gases from a leaking container by being placed at the source of the leak.*

CONTAINMENT VESSEL. A gas-tight recovery vessel designed so that a leaking *compressed gas* container can be placed within its confines thereby, encapsulating the leaking container.

☿ *A containment vessel is a closed unit that a leaking container can be placed in that will fully contain any unwanted release.*

EXCESS FLOWVALVE. A valve inserted into a *compressed gas* cylinder, portable tank or stationary tank that is designed to positively shut off the flow of gas in the event that its predetermined flow is exceeded.

☿ *Such a valve has the ability to shut down flow when the intended flow rate has been exceeded. Quite often, when the predetermined flow has been exceeded,*

a failure will occur.

HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration which falls within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

2. A chemical that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3. A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for one hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each. Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent *persons*.

☿ *This definition, as does the definition of "Toxic," gives very specific criteria in the form of lethal doses and lethal concentrations as administered to albino rats and albino rabbits. The lethal dosages are related to the ingestion and skin contact with materials, generally liquids and solids. The lethal concentrations are related to vapors, dusts, gases or mists as inhaled by albino rats. Inhalation can occur from either a gas, vapor or mist that is generated from highly toxic or toxic liquids. In some cases, a liquid may be considered highly toxic or toxic if ingested or if skin contact occurs, but vapors are not an inhalation hazard according to the criteria. These definitions give criteria to help determine what materials are regulated by this chapter and Chapter 27. Often, materials are listed as toxic or highly toxic, on MSDS, but may not necessarily meet these criteria. Instead, the terminology may be used to describe irritant characteristics of the material. For a list of common highly toxic materials, see Figure 3702.1.*

OZONE-GAS GENERATOR. Equipment which causes the production of ozone.

☿ *Ozone is considered a highly toxic gas. Ozone generators are addressed separately in Section 3705 because the code has traditionally dealt with the storage and use of hazardous materials, but not the generation.*

PHYSIOLOGICAL WARNING THRESHOLD LEVEL.

A concentration of air-borne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter (mg/m3), that represents the concentration at which *persons* can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological responses. When used in conjunction with the permissible exposure limit (PEL), the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of "Permissible exposure limit (PEL)" in Section 2702.

☿ *The term "physiological warning properties" is not defined. From a practical standpoint, the physiological warning properties are represented by a concentration of a contaminant that allows the average individual to sense its presence by a body warning signal including, but not limited to, odor, irritating effects such as stinging sensations, coughing, scratchy feeling in the throat, running of the eyes or nose and similar signals. There may be a wide variability reported for some of the more common threshold levels including that of olfactory perception. Variations that may be encountered are due to a number of factors including the methods used in their determination, the population exposed and others. The requirements for gas detection established in the code are tied to the permissible exposure limit (PEL), and there are several methods for determining the PEL inherent in the definition of that term in Section 2702.1. Including this definition intends to link the determination of the physiological warning threshold level to the data used to determine the PEL.*

For example, the PEL as established by 29 CFR is primarily based on data developed by the American Conference of Governmental Industrial Hygienists (ACGIH) called "threshold limit values (TLVs)" as referenced in the definition of "Permissible exposure limit (PEL)" found in Section 2702.1. To substantiate the TLVs (PELs), the ACGIH publishes the Documentation of the Threshold Limit Values (TLVs®) and Biological Exposure Indices (BEIs®) where the user is provided with data used in their establishment. The significant commercially available toxic and highly toxic gases with published TLVs are listed by ACGIH, and perception thresholds are provided. These warning properties are considered, as evidenced by the documentation when the TLV and hence the PEL is established. It is appropriate that the data used in the base documents be used as the basis for determining the threshold level when such data is available. The use of data from other sources may be used in the absence of data within the system used for the establishment of the PEL, but where such data has been considered in determining the PEL such data should take precedent. By providing a definition for physiological warning threshold level and guidance as to how it is to be applied, the code user is given guidance that carries out the intent of the provisions for gas detection that have been established in the code. See the commentary to Section 3704.2.2.10 for further discussion of gas detection.

REDUCED FLOW VALVE. A valve equipped with a restricted flow orifice and inserted into a *compressed gas* cylinder, portable tank or stationary tank that is designed to reduce the maximum flow from the valve under full-flow conditions. The maximum flow rate from the valve is determined with the valve allowed to

Material	Health	Flammability	Reactivity	Other	TLV/TWA Value[a]
Acrolein (CH_2:CHCHO)	3	3	2		0.1 ppm TLV/TWA
Adiponitrile (NC[CH_2]$_4$CN)	4	2	0		
Allyl Alcohol (CH_2:$CHCH_2OH$)	3	3	2		2 ppm TLV/TWA
Benzotrifluoride ($C_6H_5CF_3$)	4	3	0		
Beryllium (Be)	4	1	0		2 mcg/m^3 TLV/TWA
Bromine (Br)	4	0	0	OXY	0.3 ppm TLV/TWA
Bromine Pentafluoride (BF_5)	4	0	3	OXY~~W~~	0.1 ppm TLV/TWA
Chloropicrin (CCl_3NO_2)	4	0	3		0.1 ppm TLV/TWA
Cyanogen (NCCN)	4	4	2		10 ppm TLV/TWA
Dimethyl Sulfate ($CH_3OSO_2OCH_3$)	4	2	0		0.1 ppm TLV/TWA (skin—suspected carcinogen)
Ethylamine ($C_2H_5NH_2$)	3	4	0		10 ppm TLV/TWA
Epichlorhydrin (chloromethyl or oxirane) ([OCH_2CH]CH_2Cl)	3	3	2		0.1 ppm TLV/TWA (skin)
Hydrazine, anhydrous (H_2NNH_2)	3	3	2		0.1 ppm TLV/TWA (skin—suspected carcinogen)
Hydrogen Cyanide, anhydrous (HCN)	4	4	2		10 ppm TLV-C
Hydrogen Fluoride (HF)	4	0	0		3 ppm TLV-C
Parathion ([C_2H_5O]$_2$$PSOC_6H_4NO_2$)	4	1	2		0.1 mg/m^3 TLV/TWA
Phenol (C_6H_5OH)	3	2	0		5 ppm TLV/TWA (skin)
Sodium Hydride (NaH)	3	3	2	~~W~~	
Sodium Peroxide (Na_2O_2)	3	0	2	~~W~~	
1,1,2-Trichloroethane ($CHCl_2CH_2Cl$)—Not to be confused with 1,1,1-Trichloroethane	3	1	0		10ppm TLV/TWA (skin)

a. TLV/TWA means Threshold Limit Value/Time-weighted Average. See definition in Chapter 2 of the *International Mechanical Code*.

Figure 3702.1
COMMON HIGHLY TOXIC MATERIALS AND THEIR HAZARDS

flow to atmosphere with no other piping or fittings attached.

☿ *This is a valve that allows the maximum flow rate from a container to be reduced. For the reduction to be accurate, the maximum flow rate of a container must be known. The maximum flow rate must be determined without any piping or fittings attached to the container. This ensures that the reduction valve can actually achieve what is intended.*

TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

2. A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3. A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

☿ *See the commentary for the definition of "Highly toxic."*

SECTION 3703
HIGHLY TOXIC AND TOXIC SOLIDS AND LIQUIDS

3703.1 Indoor storage and use. The indoor storage and use of highly toxic and toxic materials shall comply with Sections 3703.1.1 through 3703.1.5.3.

☿ *As noted in the "General Comments" section, liquids and solids are dealt with in one section and gases are dealt with in another. Generally, gases pose a greater hazard because they are more difficult to contain and can have a much more immediate effect. Section 3703.1 contains requirements for indoor storage and use. Outdoor storage and use are discussed in Section 3703.2.*

3703.1.1 Quantities not exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic solids or liquids in amounts not exceeding the *maximum allowable quantity per control area* indicated in Table 2703.1.1(2) shall be in accordance with Sections 2701, 2703 and 3701.

☿ *This section sends the code user to the appropriate sections when the MAQs have not been exceeded. As with other materials, when the MAQs have not been exceeded, the requirements are less restrictive. The code user must comply with Section 3701 as well as Sections 2701 and 2703, which are the general requirements for hazardous materials related to permits; material classification and management plans; hazard identification and other basic requirements. Section 3703 would not apply.*

3703.1.2 Quantities exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic solids or liquids in amounts exceeding the *maximum allowable quantity per control area* set forth in Table 2703.1.1(2) shall be in accordance with Sections 3701, 3703.1.3 through 3703.1.5.3 and Chapter 27.

☿ *When the MAQs have been exceeded, the requirements in Sections 3701 and 3703 and all of Chapter 27 are applicable.*

3703.1.3 Treatment system—highly toxic liquids. Exhaust scrubbers or other systems for processing vapors of highly toxic liquids shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at *normal temperature and pressure*. Treatment systems and other processing systems shall be installed in accordance with the *International Mechanical Code*.

☿ This requirement is specific to highly toxic liquids and would require a treatment system to collect and process any vapors that might escape if a spill should occur at "normal temperature and pressure." In other words, if at normal temperature and pressure conditions vapors would not be highly toxic, a treatment system would not be required. The focus of this section is on the inhalation hazards associated with highly toxic materials. A material may be considered highly toxic by skin contact or ingestion, but not create an inhalation hazard because of the low volatility of the liquid.

3703.1.4 Indoor storage. Indoor storage of highly toxic and toxic solids and liquids shall comply with Sections 3703.1.4.1 and 3703.1.4.2.

☿ *This section is specific to indoor storage and focuses on floor surfaces and separation requirements.*

3703.1.4.1 Floors. In addition to the requirements set forth in Section 2704.12, floors of storage areas shall be of liquid-tight construction.

☿ *This section ensures that if a highly toxic or toxic liquid comes in contact with the floor, it will not soak and be difficult to remove. If concrete is not properly treated, spills could seep into the floor and give off vapors over time. The use of liquid-tight floors is one of the possible methods mentioned in Section 2704 for drainage control and secondary containment. The requirements of this section would apply in any case. The reference to Section 2704.12 requires the floor to be noncombustible except for the surfacing; therefore, the method used to make the floor liquid tight does not need to be noncombustible. The same requirement is stated in Section 2704.2.1.*

3703.1.4.2 Separation—highly toxic solids and liquids. In addition to the requirements set forth in Section 2703.9.8, highly toxic solids and liquids in storage shall be located in *approved* hazardous material storage cabinets or isolated from other hazardous material storage by construction in accordance with the *International Building Code*.

☿ *In order to reduce the possibility of releasing hazardous fumes and vapors due to a fire involving highly toxic liquids and solids, adequate separation from other hazardous materials is required. The intent of this section is to separate flammable, explosive or other highly reactive materials from all highly toxic solids and liquids. A 1-hour fire barrier, constructed in accordance with Section 707 of the International Building Code® (IBC®), or an approved hazardous material storage cabinet reduces the potential for involvement of highly toxic materials in a fire involving other hazardous materials. This section would not allow a physical separation or a fire barrier that extended above and to the sides of the material, as would be possible with other hazardous materials. Note that these requirements are in addition to the code's requirements for separation of incompatible materials. See the commentary to Section 2703.9.8 for further information on that topic.*

3703.1.5 Indoor use. Indoor use of highly toxic and toxic solids and liquids shall comply with Sections 3703.1.5.1 through 3703.1.5.3.

☿ *Use is more hazardous than storage because the materials are more susceptible to release. The focus of this particular section is on the transfer of highly toxic liquids and requirements for exhaust ventilation systems where highly toxic and toxic materials are being used.*

3703.1.5.1 Liquid transfer. Highly toxic and toxic liquids shall be transferred in accordance with Section 2705.1.10.

☿*This section refers the code user back to Section 2705.1.10 for requirements on the transfer of liquids with a hazard ranking of 3 or 4. These liquids can be transferred using several different methods, including safety cans, closed piping, approved pump arrangements or an approved engineered liquid transfer system, as well as by gravity under certain conditions. It should be noted that Section 2705.1.10 prohibits highly toxic liquids from being transferred where gravity feed is involved regardless of the safeguards. There are exceptions for small amounts of liquids [1.3 gallons (5 L) for a hazard ranking of 4 and 5.3 gallons (20 L) for a hazard ranking of 3]. Section 2705.1.10 is also referenced in Section 3703.2.6 for outdoor liquid*

transfer.

3703.1.5.2 Exhaust ventilation for open systems. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in *open systems* in accordance with Section 2705.2.1.1.

Exception: Liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

☿ *This section requires any open use of highly toxic or toxic liquids to be properly ventilated and refers to Section 2705.2.1.1. That section contains the general ventilation requirements for open systems using gases, liquids or solids with a hazard ranking of 3 or 4. Essentially, it requires that vapors be captured at the point of generation. The exception to both Sections 3703.1.5.2 and 2705.2.1.1 states that liquids that do not produce hazardous vapors, mists or fumes do not require compliance with these ventilation requirements. Much of this will depend on the volatility of the liquid, the degree of hazard of the liquid and how it is used.*

3703.1.5.3 Exhaust ventilation for closed systems. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in *closed systems* in accordance with Section 2705.2.2.1.

Exception: Liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

☿ *Section 2705.2.2.2 requires ventilation in accordance with Section 2705.1.1 if the closed system is designed to be opened during normal operations. Section 2705.1.1 is for open systems using materials with a hazard ranking of 3 or 4. The same exception is stated in Section 3703.1.5.2, which exempts liquids that do not produce highly toxic or toxic fumes, vapors or mists (see commentary, Section 3703.1.5.2).*

3703.2 Outdoor storage and use. Outdoor storage and use of highly toxic and toxic materials shall comply with Sections 3703.2.1 through 3703.2.6.

Outdoor storage and use is generally less hazardous than indoor storage and use because the vapors can disperse more easily to the atmosphere, posing less of a hazard to occupants and those in the vicinity of the building. Because the materials are located outside, however, there are other exposure concerns, such as weather and location of storage and use.

3703.2.1 Quantities not exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic solids or liquids in amounts not exceeding the *maximum allowable quantity per control area* indicated in Table 2703.1.1 (4) shall be in accordance with Sections 2701, 2703 and 3701.

☿ *As with indoor storage and use, when the MAQs have not been exceeded, the only requirements are those found in Section 3701 and the general requirements of Chapter 27. These requirements address issues such as permits, hazardous materials plans, pipe connections (especially with health-hazard ranking materials of 3 or 4), facility closures and hazard identification and signage.*

3703.2.2 Quantities exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic solids or liquids in amounts exceeding the *maximum allowable quantity per control area* set forth in Table 2703.1.1(4) shall be in accordance with Sections 3701 and 3703.2 and Chapter 27.

☿ *When the MAQs have been exceeded for the outdoor control areas, the requirements become more extensive. More specifically, compliance with Section 3703.2 is required in addition to Section 3701 and all of Chapter 27, as applicable.*

3703.2.3 General outdoor requirements. The general requirements applicable to the outdoor storage of highly toxic or toxic solids and liquids shall be in accordance with Sections 3703.2.3.1 and 3703.2.3.2.

☿ *This section sets general requirements for the location and the need for treatment systems to collect vapors from highly toxic liquids.*

3703.2.3.1 Location. Outdoor storage or use of highly toxic or toxic solids and liquids shall not be located within 20 feet (6096 mm) of *lot lines*, public streets, public alleys, *public ways*, *exit discharges* or *exterior wall* openings. A 2-hour *fire barrier* wall without openings or penetrations extending not less than 30 inches (762 mm) above and to the sides of the storage is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

☿ *This section requires that toxic and highly toxic solids and liquids be at least 20 feet (6096 mm) from possible exposure hazards, such as an exit discharge. The concern with highly toxic and toxic materials is the health hazards for building occupants, emergency responders and others in the immediate area. An alternative to the 20-foot (6096 mm) distance is offered in this section. Essentially, it would allow the use of a 2-hour fire barrier constructed in accordance with Section 707 of the IBC and without openings, that extends 30 inches (763 mm) above and to the sides of the storage. The wall can be either freestanding or a wall of the building that fits the requirements as a 2-hour fire barrier without openings. Generally, this wall and the distance requirements are for the protection of the toxic and highly toxic liquids and solids from fire exposures that could lead to the release of materials. Additionally, both methods allowed in this section result in a separation (by either distance or construction) from people to reduce the likelihood of contact with hazards.*

3703.2.3.2 Treatment system—highly toxic liquids. Exhaust scrubbers or other systems for processing vapors of highly toxic liquid shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at *normal temperature and pressure (NTP)*. Treatment systems and other processing systems shall be installed in accordance with the *International Mechanical Code*.

☿ *This section is the same as Section 3703.1.3 for indoor storage and the use of highly toxic liquids (see commentary, Section 3703.1.3).*

3703.2.4 Outdoor storage piles. Outdoor storage piles of highly toxic and toxic solids and liquids shall be separated into piles not larger than 2,500 cubic feet (71 m3). Aisle widths between piles shall not be less than one-half the height of the pile or 10 feet (3048 mm), whichever is greater.

☿ *The requirement in this section seeks to reduce the hazard level of a release of highly toxic and toxic liquids and solids by reducing the amount allowed in a single pile. Additionally, minimum separations between piles are required. These separations serve both as a fire barrier and as access for emergency responders. If the piles become too large, they become difficult to manage if a release should happen or a fire should occur.*

3703.2.5 Weather protection for highly toxic liquids and solids—outdoor storage or use. Where overhead weather protection is provided for outdoor storage or use of highly toxic liquids or solids, and the weather protection is attached to a building, the storage or use area shall either be equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1, or storage or use vessels shall be fire resistive. Weather protection shall be provided in accordance with Section 2704.13 for storage and Section 2705.3.9 for use.

☿ *This section is specific to outdoor storage or use of highly toxic liquids and solids when they are located in an area with weather protection attached to a building. The storage or use must be either sprinklered or placed within fire-resistive containers. Because the storage or use area is next to the building, the concern for a fire and the potential release of liquids and solids is greater. This poses a hazard to both building occupants and emergency responders. Section 2704.13 contains the general requirements for weather-protected storage and references the weather protection provisions of the IBC contained in Section 414.6.1 of that code.*

3703.2.6 Outdoor liquid transfer. Highly toxic and toxic liquids shall be transferred in accordance with Section 2705.1.10.

☿ *This section refers to Section 2705.1.10 for the general requirements for liquid transfer. This is the same*

reference used in Section 3703.1.5.1 for indoor liquid transfer (see commentary, Section 3703.1.5.1).

SECTION 3704
HIGHLY TOXIC AND TOXIC COMPRESSED GASES

3704.1 General. The storage and use of highly toxic and toxic *compressed gases* shall comply with this section.

☿ *This section requires all highly toxic and toxic gases to comply with the following subsections.*

3704.1.1 Special limitations for indoor storage and use by occupancy. The indoor storage and use of highly toxic and toxic *compressed gases* in certain occupancies shall be subject to the limitations contained in Sections 3704.1.1.1 through 3704.1.1.3.

☿ *This section places additional limitations on the storage and use of toxic and highly toxic gases in several occupancy types and uses. These are further restrictions on the MAQs given in Chapter 27.*

3704.1.1.1 Group A, E, I or U occupancies. Toxic and highly toxic *compressed gases* shall not be stored or used within Group A, E, I or U occupancies.

Exception: Cylinders not exceeding 20 cubic feet (0.566 m3) at *normal temperature and pressure (NTP)* are allowed within gas cabinets or fume hoods.

☿ *This section prohibits having any large quantities of highly toxic and toxic gases in these occupancies. With the exception of Group U, these are occupancies that have typically high occupant densities or a vulnerable population. The prohibition for Group U occupancies is likely related to the potential lack of supervision and the types of materials that are likely to be stored along with such gases.*

The exception to this section allows small amounts of gases if they are stored or used within gas cabinets or fume hoods. The allowance for small cylinders results from the small potential for release when they are stored in a cabinet or used within a fume hood and the probability that the volume of the release would be low.

3704.1.1.2 Group R occupancies. Toxic and highly toxic *compressed gases* shall not be stored or used in Group R occupancies.

☿ *This section prohibits the storage and use of highly toxic and toxic gases in all Group R occupancies without exception. Group R occupancies cover a wide variety of dwelling-type occupancies, such as one- and two-family dwellings, apartment buildings, hotels, motels, etc. The hazards posed by the storage and use of toxic or highly toxic gases would be much higher than would reasonably be anticipated by the occupants.*

3704.1.1.3 Offices, retail sales and classrooms. Toxic and highly toxic *compressed gases* shall not be stored or used in offices, retail sales or classroom portions of Group B, F, Mor S occupancies.

Exception: In classrooms of Group B occupancies, cylinders with a capacity not exceeding 20 cubic feet (0.566 m3) at *NTP* are allowed in gas cabinets or fume hoods.

☿ *This section does not completely prohibit the storage and use of highly toxic liquids in these particular occupancies, but instead focuses on certain portions of occupancies. In particular, this section addresses the offices, retail sales areas and classrooms of Group B, F, M or S occupancies. A normal storage area with no public access, therefore, could be used to store highly toxic or toxic gases, but the office incidental to that storage facility could not.*

The exception allows small cylinders in classrooms in Group B occupancies when they are used within gas cabinets or fume hoods. This acknowledges special needs at university laboratories and similar facilities.

3704.1.2 Gas cabinets. Gas cabinets containing highly toxic or toxic *compressed gases* shall comply with Section 2703.8.6 and the following requirements:

1. The average ventilation velocity at the face of gas cabinet access ports or windows shall not be less than

200 feet per minute (1.02 m/s) with a minimum of 150 feet per minute (0.76 m/s) at any point of the access port or window.

2. Gas cabinets shall be connected to an exhaust system.

3. Gas cabinets shall not be used as the sole means of exhaust for any room or area.

4. The maximum number of cylinders located in a single gas cabinet shall not exceed three, except that cabinets containing cylinders not over 1 pound (0.454 kg) net contents are allowed to contain up to 100 cylinders.

5. Gas cabinets required by Section 3704.2 or 3704.3 shall be equipped with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1. Alternative fire-extinguishing systems shall not be used.

☿ *This section sets additional requirements for gas cabinets used specifically for highly toxic and toxic gases. Section 2703.8.6 contains the general requirements for all gas cabinets. More specifically, Section 2703.8.6 sets out construction specifications, requires negative pressure for ventilation and restricts the number of cylinders to three. Section 3704.1.2 is more restrictive, requiring an air velocity of at least 200 feet per minute (1.02 m/s) at the face of the cabinet as well as a connection to an exhaust system and an area ventilation system in addition to the ventilation system in the gas cabinet. A sprinkler system is also required. Section 3704.2.2.7 would require the exhaust to be connected to a treatment system. Item 4 in Section 3704.1.2 does allow up to 100 small cylinders [under 1 pound (0.454 kg) each] instead of the restriction of three larger cylinders. This allowance recognizes the reduced potential for a large release and increases flexibility to meet the needs of the facilities such as laboratories.*

3704.1.3 Exhausted enclosures. Exhausted enclosures containing highly toxic or toxic *compressed gases* shall comply with Section 2703.8.5 and the following requirements:

1. The average ventilation velocity at the face of the enclosure shall not be less than 200 feet per minute (1.02 m/s) with a minimum of 150 feet per minute (0.76 m/s).

2. Exhausted enclosures shall be connected to an exhaust system.

3. Exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

4. Exhausted enclosures required by Section 3704.2 or 3704.3 shall be equipped with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1. Alternative fire-extinguishing systems shall not be used.

☿ *This section, like Section 3704.1.2, requires compliance with the general exhausted enclosure requirements in Section 2703.8.5. Section 2703.8.5, like Section 2703.8.6 for gas cabinets, contains basic construction specifications and requires that the enclosure be at a negative pressure. Additionally, there is a requirement in Section 2703.8.5.3 that a fire-extinguishing system be installed when the materials stored or used within the enclosure are flammable. Section 3704.1.3 additionally requires an air velocity of at least 200 feet per minute (1.02 m/s) at the face of the enclosure and that the enclosure be connected to an exhaust system that is not the sole source of ventilation for that area. In addition, this section requires a sprinkler system within the enclosure. This is independent of whether the material is considered flammable.*

3704.2 Indoor storage and use. The indoor storage and use of highly toxic or toxic *compressed gases* shall be in accordance with Sections 3704.2.1 through 3704.2.2.10.3.

☿ *This section is specific to the indoor storage and use of toxic and highly toxic gases. When Section 3704.2 applies, it focuses on the location of cylinders and the removal of unwanted releases of gases. Treatment systems are required to process any gases collected when ventilating results in the release of toxic and highly toxic gases.*

3704.2.1 Applicability. The applicability of regulations governing the indoor storage and use of highly toxic and toxic *compressed gases* shall be as set forth in Sections 3704.2.1.1 through 3704.2.1.3.

☿ *This section clarifies which requirements apply based on the amount of material in storage or in use.*

3704.2.1.1 Quantities not exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic gases in amounts not exceeding the *maximum allowable quantity per control area* set forth in Table 2703.1.1(2) shall be in accordance with Sections 2701, 2703, 3701 and 3704.1.

☿ *When the MAQs have not been exceeded, only the more general requirements would apply. These include restrictions on the storage and use in certain occupancies, piping connection requirements based on the level of health hazards, permits and other similar requirements. Tables 2703.1.1(2) and 2703.1.1(4) would require putting highly toxic gases in a gas cabinet or exhausted enclosure regardless of the amount of gases stored or used. These gas cabinets and exhausted enclosures need to be in accordance only with the basic requirements of Chapter 27 and do not need to be connected to a treatment system.*

3704.2.1.2 Quantities exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic gases in amounts exceeding the *maximum allowable quantity per control area* set forth in Table 2703.1.1(2) shall be in accordance with Sections 3701, 3704.1, 3704.2 and Chapter 27.

☿ *If the MAQs have been exceeded, the requirements become much more extensive. This requires compliance with all applicable sections of Chapter 27 and also Section 3704.2, which has requirements for treatment systems and gas detection systems.* ***3704.2.1.3 Ozone gas generators****. The indoor use of ozone gas-generating equipment shall be in accordance with Section 3705.*

☿ *This section is a specific reference to Section 3705, which deals with the process of ozone generation. The operation is unique and, therefore, has unique requirements. The requirements in Section 3705 apply when the ozone-generating capacity exceeds 0.5 pound (0.227 kg) in a 24-hour period.*

3704.2.2 General indoor requirements. The general requirements applicable to the indoor storage and use of highly toxic and toxic *compressed gases* shall be in accordance with Sections 3704.2.2.1 through 3704.2.2.10.3.

☿ *The requirements in this section are for both storage and use of toxic and highly toxic gases when the MAQs have been exceeded.*

3704.2.2.1 Cylinder and tank location. Cylinders shall be located within gas cabinets, exhausted enclosures or gas rooms. Portable and stationary tanks shall be located within gas rooms or exhausted enclosures.

☿ *Toxic and highly toxic gases pose a high threat to occupants and emergency responders if released to the atmosphere; therefore, this section places restrictions on where cylinders and tanks can be located. More specifically, cylinders must be in a gas cabinet or within gas rooms or exhausted enclosures. Tanks, both portable and stationary, must be either in a gas room or an exhausted enclosure. Gas cabinets are not an option because of the size of portable and stationary tanks. Gas cabinets, exhausted enclosures and gas rooms have specific requirements in Sections 3704.1.2, 3704.1.3 and 3704.2.2.6, respectively, in addition to the general requirements in Chapter 27.*

3704.2.2.2Ventilated areas. The room or area in which gas cabinets or exhausted enclosures are located shall be provided with exhaust ventilation. Gas cabinets or exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

☿ *This section requires that gas cabinets and exhausted enclosures not be the only ventilation provided when toxic or highly toxic gases are stored or used. The room or area must have additional ventilation. The exhaust ventilation for the room need not be processed through a treatment system.*

3704.2.2.3 Leaking cylinders and tanks. One or more gas cabinets or exhausted enclosures shall be provided to handle leaking cylinders, containers or tanks.

Exceptions:

1. Where cylinders, containers or tanks are located within gas cabinets or exhausted enclosures.

2. Where *approved* containment vessels or containment systems are provided in accordance with all of the following:

2.1. Containment vessels or containment systems shall be capable of fully containing or terminating a release.

2.2. Trained personnel shall be available at an *approved* location.

2.3. Containment vessels or containment systems shall be capable of being transported to the leaking cylinder, container or tank.

☿ *Section 3704.2.2.1 requires the use of gas cabinets, exhausted enclosures or gas rooms for the storage of cylinders and tanks. This section takes the requirements one step further and requires that one or more additional gas cabinets or exhausted enclosures be provided and ready to receive leaking cylinders or tanks. Exception 1 is for cylinders and tanks that are already contained within gas cabinets or exhausted enclosures. Exception 2 allows the use of containment vessels and containment systems in place of a gas cabinet or exhausted enclosure to address the release of gases. There are several conditions, which include that the vessel or system actually contain the potential release, that a trained person be available and that the containment vessel or system be transportable to the leaking cylinder or tank.*

3704.2.2.3.1 Location. Gas cabinets and exhausted enclosures shall be located in gas rooms and connected to an exhaust system.

☿ When gas cabinets and exhausted enclosures are used with leaking tanks, they must be contained within gas rooms. Containment vessels and systems would not have to be located within a gas room.

3704.2.2.4 Local exhaust for portable tanks. A means of local exhaust shall be provided to capture leaks from portable tanks. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the tank. The local exhaust system shall be located in a gas room. Exhaust shall be directed to a treatment system in accordance with Section 3704.2.2.7.

☿ *This section requires portable tanks located in gas rooms to have an additional local exhaust mechanism. More specifically, Section 3704.2.2.1 requires locating portable tanks in a gas room or exhausted enclosure as a minimum. Since exhausted enclosures would be considered local, an additional local exhaust system would not be required. Only when the sole exhaust mechanism is a gas room would a local exhaust be required. The exhaust from the gas room and the local exhaust system must be processed through a treatment system in accordance with Section 3704.2.2.7. The focus of a local exhaust system should be on the valves or valve fittings where a leak is more likely.*

3704.2.2.5 Piping and controls—stationary tanks. In addition to the requirements of Section 2703.2.2, piping and controls on stationary tanks shall comply with the following requirements:

1. Pressure relief devices shall be vented to a treatment system designed in accordance with Section 3704.2.2.7.

Exception: Pressure relief devices on outdoor tanks provided exclusively for relieving pressure due to fire exposure are not required to be vented to a treatment system provided that:

1. The material in the tank is not flammable.

2. The tank is not located in a diked area with other tanks containing combustible materials.

3. The tank is located not less than 30 feet (9144 mm) from combustible materials or structures or is shielded by a *fire barrier* complying with Section 3704.3.2.1.1.2. Filling or dispensing connections shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system in accordance with Section 3704.2.2.7.3. Stationary tanks shall be provided with a means of excess flow control on all tank inlet or outlet connections.

Exceptions:

1. Inlet connections designed to prevent backflow.

2. Pressure relief devices.

☿ *This section is simply in addition to Section 2703.2.2, which addresses piping, tubing, valves and fittings in general for all hazardous materials. This section focuses on exhaust ventilation for potential leaks and releases associated with piping, filling and dispensing connections on stationary tanks. Section 2703.2.2 contains general requirements covering issues such as compatibility, shutoff valves, backflow prevention and leak detection. This section is specific to stationary tanks because they are more permanent and piping and other controls are more likely on stationary tanks versus portable tanks and cylinders. The specific requirements found in this section are as follows:*

1. If a pressure relief valve is used, the potential release must be vented directly to a treatment system. There is an exception that pertains to outdoor tanks with pressure valves specifically for pressure relief in a fire. There are several conditions for the exception that address exposure hazards, such as neighboring tanks or combustible hazards. Also, the material in the tank itself cannot be flammable. Although this exception for outdoor tanks is found within the indoor storage and use requirements, Section 3704.3 for outdoor storage and use has a specific requirement within Section 3704.3.2.3 that refers back to this section for piping and controls for outdoor stationary tanks.

2. This item requires a local exhaust system connected to a treatment system for filling and dispensing connections.

3. Excess flow control is required at every tank inlet and outlet to reduce the size of the release and to avoid dangerous reactions and overpressures in other areas of a process designed for a particular flow rate and pressure. There are two exceptions that relate to devices serving a specific purpose, which include an inlet connection designed to address back-flow or a pressure relief valve. A pressure relief valve is specifically designed to allow excessive flow beyond the design pressures of the tank to avoid overpressures in the tank.

3704.2.2.6 Gas rooms. Gas rooms shall comply with Section 2703.8.4 and both of the following requirements:

1. The exhaust ventilation from gas rooms shall be directed to an exhaust system.

2. Gas rooms shall be equipped with an *approved automatic sprinkler system*. Alternative fire-extinguishing systems shall not be used.

☿ *The requirements in Chapter 27 address construction and basic ventilation. General gas room requirements are found in Section 2703.8.3. More specifically, Section 2703.8.3 requires an automatic sprinkler system, separation as required in the IBC and maintaining negative pressure in the room. This section takes the requirements one step further and requires that exhaust ventilation be directed to an exhaust system. Section 3704.2.2.7 also requires directing this exhaust system to a treatment system. The second criterion is a restriction that does not allow any alternative fire-extinguishing systems in place of an automatic sprinkler system.*

3704.2.2.7 Treatment systems. The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems required in Sections 3704.2.2.4 and 3704.2.2.5 shall be directed to a treatment system. The treatment system shall be utilized to handle the accidental release of gas and to process exhaust ventilation. The treatment system shall be designed in accordance with Sections 3704.2.2.7.1 through 3704.2.2.7.5 and Section 510 of the *International Mechanical Code*.

Exceptions:

1. Highly toxic and toxic gases—storage. A treatment system is not required for cylinders, containers and tanks in storage when all of the following controls are provided:

1.1. Valve outlets are equipped with gas- tight outlet plugs or caps.

1.2. Hand-wheel-operated valves have handles secured to prevent movement.

1.3. *Approved* containment vessels or containment systems are provided in accordance with Section 3704.2.2.3.

2. Toxic gases—use. Treatment systems are not required for toxic gases supplied by cylinders or portable tanks not exceeding 1,700 pounds (772 kg) water capacity when the following are provided:

2.1. A *listed* or *approved* gas detection system with a sensing interval not exceeding 5 minutes.

2.2. A *listed* or *approved* automatic-closing fail-safe valve located immediately adjacent to cylinder valves. The fail-safe valve shall close when gas is detected at the permissible exposure limit (PEL) by a gas detection system monitoring the exhaust system at the point of discharge from the gas cabinet, exhausted enclosure, ventilated enclosure or gas room. The gas detection system shall comply with Section 3704.2.2.10.

☿ *Treatment systems are required for all exhaust ventilation and accidental releases of toxic and highly toxic gases. A treatment system essentially treats the exhaust through methods such as diluting, absorbing, burning and other various methods, which are discussed in Section 3704.2.2.7.1. Generally, Section 3704.2.2.7 and related subsections contain the design criteria for such systems.*

There are two overall exceptions where treatment systems would not be required. They are broken into storage and use, respectively. Treatment systems can be very costly and the exceptions give credit to situations where the hazard is low and the benefit of a costly treatment system cannot be justified. Exception 1 deals with cylinders, containers and tanks in storage. A treatment system would not be required if all three criteria are met. The criteria include caps or plugs on any valves to provide a level of redundancy in case of an accidental release; hand-wheel operated valves that are secured in place and the installation of containment vessels or containment systems.

Exception 2 is for toxic gases supplied by cylinders limited to a size of 1,700 pounds (772 kg) water capacity. The 1,700-pound (772 kg) limit was derived as follows: A ton container typically holds about 1,600 pounds (726 kg) of water, and a filling density of approximately 125 percent of the water capacity is allowed for chlorine [1,600 x 1.25 = 2,000 pounds (908kg)].

The resulting weight of product in a filled container is one ton for chlorine. The maximum capacity of 1,700 pounds versus 1,600 pounds (772 kg versus 726 kg) is intended to accommodate manufacturing variations that occur from one container to the next, but this does not affect the ultimate gas capacity of a filled container, which is limited to 2,000 pounds (908 kg) regardless of the variation in water capacity. To avoid the use of a treatment system, a gas detection system must also be accompanied by a fail-safe valve adjacent to the cylinder valve. The fail-safe valve must operate when gas is detected at the point of discharge of the location of the cylinder (see commentary, Section 202 for definition of "Fail-safe"). Section 3704.2.2.1 requires cylinders to be located in a gas cabinet, an exhausted enclosure or a gas room.

3704.2.2.7.1 Design. Treatment systems shall be capable of diluting, adsorbing, absorbing, containing, neutralizing, burning or otherwise processing the contents of the largest single vessel of compressed gas. Where a total containment system is used, the system shall be designed to handle the maximum anticipated pressure of release to the system when it reaches equilibrium.

☿ *This section states that a treatment system must process the exhaust ventilation or an accidental release. Various methods are listed but the section is written to allow exploration of other methods. Additionally, this section sets important capacity criteria for the treatment system, which would require it to either be capable of processing the largest vessel or handle the maximum pressure of release at equilibrium when a total containment system is used.*

3704.2.2.7.2 Performance. Treatment systems shall be designed to reduce the maximum allowable discharge concentrations of the gas to one-half immediate by dangerous to life and health (IDLH) at the point of discharge to the atmosphere. Where more than one gas is emitted to the treatment system, the treatment system shall be designed to handle the worst-case release based on the release rate, the quantity and the IDLH for all *compressed gases* stored or used.

☿ *Now that the method and the capacity have been established in Section 3704.2.2.7.1, the actual treatment capabilities are described in this section. More specifically, this section describes how well the gases need to be treated. Once treated, the output from the treatment system must not exceed one-half of the Immediately Dangerous to Life and Health (IDLH) concentration. If the treatment system is used for a variety of different stored gases that have various levels of toxicity, the treatment system must be able to accommodate the worst-case situation. As an example, the least toxic gas may have the largest release potential,*

but the treatment system does not have to work as hard to reduce the IDLH; therefore, both the level of hazard and the amount of the gas must be addressed.

3704.2.2.7.3 Sizing. Treatment systems shall be sized to process the maximum worst-case release of gas based on the maximum flow rate of release from the largest vessel utilized. The entire contents of the largest *compressed gas* vessel shall be considered.

☿ *This section re-emphasizes that the treatment system must be capable of treating the largest single vessel. In addition, this section requires that the maximum flow rates be considered; therefore, it is not simply the capacity of the largest single vessel but also how fast that gas is released. Treatment systems need to account for only a single failure of a vessel, but at the highest flow rate.*

3704.2.2.7.4 Stationary tanks. Stationary tanks shall be labeled with the maximum rate of release for the *compressed gas* contained based on valves or fittings that are inserted directly into the tank. Where multiple valves or fittings are provided, the maximum flow rate of release for valves or fittings with the highest flow rate shall be indicated. Where liquefied *compressed gases* are in contact with valves or fittings, the liquid flow rate shall be utilized for computation purposes. Flow rates indicated on the label shall be converted to cubic feet per minute (ft3/min) (m3/s) of gas at *normal temperature and pressure (NTP).*

☿ *The potential release rates of all valves directly connected to the tank that have the potential for a release of gases must be properly labeled. In addition, the valves that have the highest potential release rates need to be specifically identified. This is especially important when there are multiple valves. Another requirement of this section is for situations in which the valve is located where it is interacting with the liquid form of the compressed gas. Such interaction will alter the release rate; therefore, the liquid rate of release must be used. When a gas is in liquid form it is denser than the gas form. If released, the liquid vaporizes, expanding into a much larger volume of gas. Finally, to more readily assess the amount of gas that can be released into the room or area, the tank liquid flow rate must be shown on the label as the equivalent gas volume in cubic feet per minute at normal temperature and pressure (NTP). In other words, the flow rate is not as important as the gas volume it will produce when released into the room or area. NTP provides a comparable base value.*

3704.2.2.7.5 Portable tanks and cylinders. The maximum flow rate of release for portable tanks and cylinders shall be calculated based on the total release from the cylinder or tank within the time specified in Table 3704.2.2.7.5. When portable tanks or cylinders are equipped with *approved* excess flow or reduced flow valves, the worst-case release shall be determined by the maximum achievable flow from the valve as determined by the valve manufacturer or *compressed gas* supplier. Reduced flow and excess flow valves shall be permanently marked by the valve manufacturer to indicate the maximum design flow rate. Such markings shall indicate the flow rate for air under *normal temperature and pressure.*

☿ *Because the flow rates of different portable tanks and cylinders tend to vary because of their portability, this information would be difficult to track; therefore, this section simply requires that the maximum flow rate be determined based on the capacity of the tank and the time prescribed in Table 3704.2.2.7.5. For example, say a portable tank had a capacity (at NTP) of 1,000 cubic feet (28 m3) and was not under liquefied conditions. The maximum rate of release based on the criteria given in Table 3704.2.2.7.5 would be as follows: 1,000 cubic feet/40 minutes = 25 cubic feet per minute at NTP In some cases, portable tanks and cylinders may be equipped with valves that either alter the rate of flow or will stop in the case of flow over the designed rate. In those cases, credit is given to the actual amount of gas released at NTP in determining the maximum flow rate. Valves that are used in this manner must be properly labeled to note the specific flow rate at NTP or function.*

TABLE 3704.2.2.7.5
RATE OF RELEASE FOR CYLINDERS AND PORTABLE TANKS

VESSEL TYPE	NONLIQUEFIED (minutes)	LIQUEFIED (minutes)
Containers	5	30
Portable tanks	40	240

3704.2.2.8 Emergency power. Emergency power in accordance with the Section 604 and NFPA 70 shall be provided in lieu of standby power where any of the following systems are required:

1. Exhaust ventilation system.
2. Treatment system.
3. Gas detection system.
4. Smoke detection system.
5. Temperature control system.
6. Fire alarm system.
7. Emergency alarm system.

Exception: Emergency power is not required for mechanical exhaust ventilation, treatment systems and temperature control systems where *approved* fail-safe engineered systems are installed.

☿ *Because of the immediate health hazard posed by the release of toxic or highly toxic gases, emergency, rather than standby, power is required. The major difference between them is that standby power activates within 60 seconds whereas emergency power activates within 10 seconds. This section provides a fairly specific list of systems that would require emergency power. The most critical is likely the treatment system. The exception allows standby power only if a fail-safe engineered system is installed that will shut down in a manner that will contain the gases.*

3704.2.2.9 Automatic fire detection system—highly toxic compressed gases. An *approved* automatic fire detection system shall be installed in rooms or areas where highly toxic *compressed gases* are stored or used. Activation of the detection system shall sound a local alarm. The fire detection system shall comply with Section 907.

☿ *This section requires a fire detection system in rooms or areas where highly toxic gases are stored or used. The intent is that a fire within the area could lead to the release of the highly toxic gases. Fires can heat gases stored and cause expansion, leading to overpressures and releases; therefore, warning of a fire is critical to avoiding such releases. The alarm system needs to provide a local alarm at the building, but the detection is required only in the room or area where the highly toxic gas is stored.*

3704.2.2.10 Gas detection system. A gas detection system shall be provided to detect the presence of gas at or below the PEL or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the IDLH limit.

Exception: A gas detection system is not required for toxic gases when the physiological warning threshold level for the gas is at a level below the accepted PEL for the gas.

☿ *This section requires a system to detect the presence of gas in a large enough concentration to exceed the PEL. The system must also be designed to be capable of detecting whether one-half the IDLH has been exceeded at the discharge from the treatment system. This is to ensure that the treatment system is working to capacity or to indicate that there may be other problems, such as a release larger than the treatment system has been designed to handle. It is important to stress the terminology of "capable," which would not require monitoring but would require an installation that would enable such monitoring if desired. In many cases, monitoring is done intermittently with portable monitors. Such monitoring may become necessary as a result of environmental restrictions, which are beyond the scope of the code. There is an exception to the requirement of a gas detection system where the odor of the gas or its physical effects are noticeable far before the PEL is reached. Those indicators should be sufficient to notify people to leave the area.*

3704.2.2.10.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

Exception: Signal transmission to a constantly attended control station is not required where not more than one cylinder of highly toxic or toxic gas is stored.

☿ *Once the gas is detected at the levels noted in Section 3704.2.2.10, a local alarm must be initiated and a signal at a constantly attended control station (such as a security room or fire command center) must be transmitted. The alarm is intended to alert those both inside the particular area of detection and in the immediate vicinity. This is to prevent any gases that might escape from causing harm to those outside the area of release since they were not aware of the activities within the building.*

The notification to the control station provides information to those who must take a role in emergency response, whereas the local alarm is a warning for those in the vicinity of the release. A signal need not be sent to the control station if the amount of gas stored or used is a maximum of one cylinder. In that case, a local alarm is sufficient to notify people of the immediate hazard.

3704.2.2.10.2 Shut off of gas supply. The gas-detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

Exception: Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic *compressed gases* where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).

2. Constantly attended.

3. Provided with readily accessible emergency shutoff valves.

☿ *The gas detection system also initiates the shutdown of gases at the source for gas supply piping and tubing, making this requirement applicable to the use of the gas more so than to storage. The exception applies only to equipment used to make toxic or highly toxic gases, and only when all three of the stated conditions are met. This exception recognizes that pressure is a critical element in how much and how fast a gas is released. A low operating pressure normally means a smaller, more easily controlled release. Having an operator monitoring the equipment at all times is considered an adequate safeguard when shutoff valves are easy to reach in case of an emergency. Under these circumstances, notification by an alarm system and a signal to a constantly attended control station is sufficient to deal with the particular hazard. Automatic shutoff would probably be overly restrictive.*

3704.2.2.10.3 Valve closure. Automatic closure of shutoff valves shall be in accordance with the following:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.

2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and *compressed gas* containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.

3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

Exception: When the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

☿*This section describes three common situations in which gas lines need to automatically close when gas is detected. If the gas is detected within a gas cabinet or exhausted enclosure, only the gas line related to the gas cylinder or container within the cabinet or enclosure must be shut down. If the gas is detected within a gas room, all gas lines containing that particular gas must be shut down because it is difficult to determine where the leak originates when the storage and use are in a larger area. The next criterion is related to situations where the gas sampling occurs within a piping manifold enclosure. Gas sampling in such locations is much more localized and the code requires shutting*

down only the cylinder supplying the manifold. The exception is for situations where the gas is clearly being released downstream from the piping distribution manifold enclosure. The problem is with the piping or perhaps at a point of use and can be isolated by simply shutting off that particular branch line from the piping distribution manifold enclosure. This would be allowed only if the gas detection system was sampling at the location of use or within a gas valve enclosure downstream from the distribution piping. Otherwise, it would be difficult to determine where the leak originated and the supply at the cylinder or tank would have to be shut down.

3704.3 Outdoor storage and use. The outdoor storage and use of highly toxic and toxic *compressed gases* shall be in accordance with Sections 3704.3.1 through 3704.3.4.

☿ *Outdoor storage and use is generally less hazardous than indoor storage and use because the toxic and highly toxic gases, if released, are more easily diluted and, thus, the hazard to the people in the surrounding area is reduced. When gases are released outdoors, however, it is more difficult to control where the released gases will go and what or who is being exposed to the hazards; therefore, this section contains restrictions on locations and distance to exposures. This section refers back to many of the requirements found in Section 3704.2, such as for piping and controls for stationary tanks and gas detection.*

3704.3.1 Applicability. The applicability of regulations governing the outdoor storage and use of highly toxic and toxic *compressed gases* shall be as set forth in Sections 3704.3.1.1 through 3704.3.1.3.

☿ *This section defines which requirements of the code apply based on the amount of gases stored and used.*

July 2011— International Code Council Update

Deadline Extended for 2011 Code Council Awards Nominations

Nominations are being accepted for the ICC Awards to be presented Oct. 30 - Nov. 6 at the 2011 ICC Annual Conference in Phoenix. ICC Awards will be presented in several categories to honor individuals and organizations for accomplishments and service to building safety and ICC. The submission deadline has been extended to July 29. The nomination form is here:

http://www.iccsafe.org/newsroom/annual/Documents/2011Phoenix/2011AwardsNominationForm.pdf

Submit Proposals for Cracker Barrel Session at 2011 Annual Conference

The Code Council is seeking proposals for the Cracker Barrel session at the 2011 Annual Conference in Phoenix. The Cracker Barrel is a round table discussion presented during lunch. The presenter should be prepared to deliver a 20-minute presentation (three times) within the allotted time frame. Deadline for proposals is August 1. Submit on the website at http://www.iccsafe.org/Education/Pages/2011CallPresentations.aspx.

ICC Call for 2012/2013 IgCC and ISPSC Committees

At this time, ICC is receiving applications for members for both of the IgCC Committees and the ISPSC Committee. Code Committee members are considered for appointment by the newly formed Codes and Standards Council with final approval resting with the ICC Board of Directors. 2011 IgCC and ISPSC Code Committee members who presided over the 2011 Code Development Hearing and whose term expires December 31, 2011, must reapply to be considered for re-appointment. Application deadline: August 1, 2011. More info here: http://www.iccsafe.org/cc/Pages/2012-13Call.aspx

Note: This call completes the Call for Committee for the 2012/2013 Cycle for all code committees. All other code committees were covered under the posted Call on February 3, 2011 for which the application deadline of June 1, 2011 has expired and the May 25th updated Call for the Commercial and Residential Energy Code Committees which has an application deadline of July 1, 2011.

Member-Only 1-Cent Sale!

To express ICC's appreciation to their members, we want to offer you the *SFPE Code Official's Guide to Performance-Based Design Review* book for only a penny! All we ask is that you pay for the cost of shipping. This value added, Member-Only offer is limited to one book per customer. Supplies are limited to stock on hand, so don't wait, login to the ICC web site now to obtain your promo code for this special offer. Go on, click here: http://www.iccsafe.org/Membership/Pages/PennySale.aspx

Follow Code Technology Committee Activity

The Code Technology Committee is currently very active and is dealing with quite a few cutting edge topics, including: Balanced Fire Protection, Carbon Monoxide Detectors, Care Facilities Child Window Safety, Climbable Guards, Elevator Lobbies, Emergency Evacuation with Elevators, IBC Coordination with the new ADAAG, Labeling of Fire Rated Glazing, NIST World Trade Center Recommendations, and Unenclosed Exit Stairs. If you are interested in any of these topics and the work ICC is doing on them, you can find out more here: http://www.iccsafe.org/cs/CTC/Pages/default.aspx