NCDOI OSFM Evaluation Services

Scope of DOI White Paper: The Purpose of this document is to provide clarification and suggested best practices on North Carolina State Code requirements to Code Enforcement Officials (CEO) who are agents for the Authority Having Jurisdiction (AHJ).

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Note: Words appearing in italics throughout the document are defined in Appendix A.

1.0 Intent

To introduce code requirements for hazardous materials (HAZMAT). The building codes categorize hazardous materials as liquids, solids or gases which pose a physical and/or health hazard.

The codes address hazardous materials as a threat to property and life safety because they are commonly associated with being flammable, combustible, oxidizing, unstable/reactive, or toxic. These materials can be responsible for a number of challenges during an emergency including reduced time for evacuation and accelerated spread of fire.

In addition to the obvious goal of limiting exposure to the occupants of a building from the negative properties of hazardous materials, it is important to recognize the potential threat to first responders in a building containing hazardous materials. Responding to an emergency event involving unexpected hazardous materials can be one of the most dangerous situations a first responder may face. Without the properly planned response measures and equipment, there is an elevated risk of injury, exposure or death to both the responders and the public. To ensure
the responders are prepared for what they may face, accurate and current information is needed on materials located in a building and the associated hazards. Hazardous substances are to be stored and handled in a way that minimizes the risks posed by those substances and which limits exposure to them. When identifying a hazard associated with a material, a Material Safety Data Sheet (MSDS) is prepared. Similar to the criteria used in NFPA 704, a MSDS will quantify the hazard associated with a material so that the material can be properly classified and hazardous condition can be mitigated.

HAZMAT issues are often associated with laboratory or research buildings, but they can also be encountered in areas such as those used for heavy equipment repair, museum display, theater prop fabrication, prison enterprises, print shops, manufacturing facilities and storage of tires, paint, finishing materials, swimming pool supplies, farm chemicals, and petroleum products, among many others. Most people encounter hazmats every day without being fully aware of the elevated risk they are exposed to. Places such as a service station or a hardware store or paint store must be evaluated for hazardous materials to ensure that minimum life safety requirements of the code are implemented.

2.0 Code References

A. Unless otherwise stated, all code references are to the 2012 North Carolina State Building Codes (NCSBC).

B. North Carolina Building Code (NCBC) applicable portions include but are not limited to:
   1. Chapter 3, Section 307 and Tables 307.7(1), 307.1(2)
   2. Chapter 4, Section 414, 415 and Tables 414.2.2, 414.2.5, 415.8.2.1.1

C. North Carolina Fire Code (NCFPC) applicable portions include but are not limited to:
   1. NCFPC, Chapter 18, Tables 1804.2.2.1, 1805.2.2
   2. NCFPC, Chapters 27 through 44.
   3. Appendices E and F

3.0 North Carolina Code Requirements, Required Submittals and Permit Requirements

A. Code Requirements- NCBC, Section 414 and NCFPC, Section 2701 contain the requirements the Building official and the designer need to consider when designing for and reviewing for hazardous materials. They include:
   1. Where and how the material is to be used and stored
   2. Material type and classification
   3. Quantity of materials in each individual room or space or control area
   4. Special requirements based on the specific material
   5. Location of control areas (See Appendix A for definitions)
   6. Rating of fire barrier construction between control areas
   7. Type of fire alarm system and automatic smoke detection
   8. Type of sprinklers or other fire suppression systems
   9. Types of ventilation, mechanical and electrical systems with emergency or stand-by power
   10. Hazardous Material Management Plan (HMMP) - NCFPC, Section 2701.5.1. This plan is to contain the following information:
       • Access to each storage and use area
       • Location of emergency equipment
• Location where liaison will meet emergency responders
• Facility evacuation meeting point locations
• The general purpose of other areas within the building.
• Location of all above-ground and underground tanks and their appurtenances including, but not limited to, sumps, vaults, below-grade treatment systems and piping.
• The hazard classes in each area.
• Locations of all control areas and Group H Occupancies.
• Emergency exits.

11. Hazardous Material Inventory Statement (HMIS) - NCFPC, Section 2701.5.2. This statement is to contain the following information:
   • Product name.
   • Component.
   • Chemical Abstract Service (CAS) number.
   • Location where stored or used.
   • Container size.
   • Hazard classification.
   • Amount in storage.
   • Amount in use-closed systems.
   • Amount in use-open systems.

12. Permits shall be required as per NCFPC, Sections 105.1, 105.6 through 105.7
   • Mandatory permits
   • Optional permits
   • See Table 105.6.20 for permit amounts for hazardous materials.

B. For Submittal to Fire Code Official:
   1. Construction documents as per NCFPC Section 105.4
   2. The HMMP as required by the Fire Code Official
   3. The HMIS as required by the Fire Code Official

C. For submittal to Building Code Official:
   1. Construction Documents as per 2012 NC Administrative Code and Policies (NCACP, Section 104). These documents are to include floor plans showing location of all materials, storage cabinets if applicable, contents and processes, and fire-ratings of walls, floors, ceilings.
   2. Information is to be provided to determine if the building or any part of the building will be classified as Hazardous Occupancy or require control areas.
   3. Locations of hazardous storage areas, and how each location will be protected are to be shown on the plans.
   4. Opinion and report, as stated in NCBC, Section 414.1.3, “… prepared by qualified person, firm or corporation approved by the building official .... ”shall be provided to the enforcing agency.

4.0 Hazardous Materials and Plan Review

The Code establishes a threshold when the quantity of a hazard material represents an extraordinary hazard and may cause the re-classification of a use group. Recognizing these thresholds is important in the early part of a project because they can enable the building owner
to better estimate construction, operation and maintenance costs.

Mitigation of these hazards may include reduction in material quantity or change of material, rated separations, and installation of approved storage cabinets to increase the maximum allowable quantities of materials in a building. Information such as the types of hazardous materials, quantities, storage arrangements, and rated assemblies are very important at the schematic stages of plan review.

The Building Department and/or Fire Marshal’s office should have hazardous material classification resources on hand to effectively evaluate the validity of the design of a structure where hazardous materials will be stored or used. Examples include:

A. The Hazardous Material Expert Assistant report (HMEX)- this program is available from the ICC store. [http://www.iccsafe.org/Store/Pages/Product.aspx?id=9405CD6#longdesc](http://www.iccsafe.org/Store/Pages/Product.aspx?id=9405CD6#longdesc)

1. The bullets below are from the ICC website and explain the HMEX program:
   - Hazard classifications and definitions are correlated with the IFC® and IBC®.
   - Chemicals can be identified from a classified database. The data can be accessed by chemical name, synonym, partial name, CAS registration number, or RTECS number, includes physical and chemical properties. The physical state of the material along with code identified physical and health hazard properties are included.
   - Methodology developed by FEMA/DOT/EPA first published in the 1990 Handbook of Chemical Hazard Analysis Procedures allows the user to screen the consequences of the inadvertent mixing of two materials.
   - It is available on CD-ROM in a Microsoft® Windows® compatible single-user version.

2. The Building Department Code Enforcement and/or Fire Marshal’s staff may require additional information for verification of code compliance or equivalence. The additional information is necessary to ensure that all risks to the public or to the emergency responders are addressed in the design and occupancy of the facility where the materials are present.

B. MSDS Sheets – Defined in NCFPC, section 2702 as: Information concerning a hazardous material which is prepared in accordance with the provisions of DOL29 CFR Part 1910.1200 or in accordance with the provisions of a federally approved state OSHA plan. Click here for [sample MSDS sheet for Silane](http://www.iccsafe.org/Store/Pages/Product.aspx?id=9405CD6#longdesc)

1. The following information is typically found on an MSDS Sheet
   - Product name and Company Identification
   - Composition and Ingredient information
   - Hazards Identification
   - First Aid Measures
   - Fire Fighting Measures
   - Accidental Release Measures
   - Handling and Storage
   - Exposure Control/Personal Protection
   - Chemical and Physical Properties
   - Stability and Reactivity
   - Toxicological Information
• Ecological Information
• Disposal Information
• Transport Information
• Regulatory Information
• Additional information on the product.

2. Occasionally manufacturers are reluctant to provide MSDS sheets due to “trade secrets”. Be aware that labeling a substance as a “trade secret” does not negate the requirement to provide the classification(s) of the substance to the CEO. While knowing the exact chemical composition is not necessary, it is important to still relay the material properties such as flash point or boiling point to the jurisdiction.

C. Examples of Hazardous Material Worksheets

1. Following are excerpts from two example worksheet formats used by plan reviewers. Both have been used (either as they are presented here or modified to suit the project) on many projects reviewed by DOI and have been found to be useful by owners and designers. The first worksheet is the Classification and Location Worksheet (figure 1). The second worksheet is the Allowable Quantities Worksheet (figures 3 and 4).

D. The first step in the hazardous material evaluation process is for the owner, designer or consultant to prepare the information on hazardous materials to be present on their site in a worksheet. The plan reviewer will then review this worksheet to evaluate the code compliance of the hazardous material aspect of the project design. Using Excel to prepare a worksheet is useful, especially for a building where there are several materials classified as hazardous. When using the “SUM” formula in Excel, the columns can be automatically added, thereby minimizing errors. This will show the user if the maximum allowable quantities have been exceeded for the material and/or control area between storage and use (open and/or closed).

1. An important aspect of the evaluation of hazardous materials that is often overlooked is consideration of compatible and incompatible materials. Special knowledge of the materials is required to determine compatibility or lack thereof. This information can be found on the MSDS and, if using a spreadsheet similar to one shown in figure 1, this information would be put in the “comments” column. See Section 2703.9.8. of the NCFPC for additional requirements.

   a. Provide a detailed chart of all potential hazardous chemicals/materials to be used within this building per control area classified by quantity, material and class as per NCBC Table 307.7(1) and Table 307.1(2) or NCFPC Table
b. List all associated classifications. One material can, and usually does, have several hazard classifications. (Note in figure 1 that Acetic Anhydride is a class II combustible liquid, a water reactive class I and an irritant.) There are many resources for determining the hazard classifications for a given material (See 5.0- Resources).

c. Indicate all locations in the building where the material will be used or stored and how much in each location. NCBC, Table 414.2.2 and NCFPC Table 2703.8.3.2. (figure 2) show the percentage reduction on floors other than ground level. This table also lists the number of control areas permitted on each floor level and the required fire separation for each control area. For example, you might have 300 gallons of Combustible Liquid, class II located in 4 labs on 3 different floors in a chemistry building. While the first floor would allow 100% (300 gallons) of the exempt quantity, the 2nd floor allows 75% (225 gallons) of the exempt quantity, and the 3rd floor reduces the allowable exempt quantity by 50% (150 gallons). Each location and the quantity in that respective location should be listed separately. This is necessary to determine the quantity in a particular control area and to determine if more than one control area is required. A small amount of certain types of materials can have a dramatic impact. If the designer is not given complete and accurate hazardous material information, the design may have to be extensively modified before it can be approved, impacting the project's cost and schedule.

d. Describe how the material will be used. Will it be stored only, dispensed in an open or closed system, used in Hazardous Production Material (HPM) process, etc.? This is necessary to determine the exempt quantity and minimum required protection, separation, or containment measures associated with those specific issues.

2. The following is information to assist in preparing the Allowable Quantities Worksheet that may be required by the AHJ. (figures 3 & 4). The code allowed exempt quantity is to be listed for each individual chemical/material per control area (NCBC Table 414.2.2 or NCFPC Table 2703.8.3.2). Exempt quantities are obtained from NCBC Tables 414.2.5, 415.8.2.1.1, 307.7 (1), 307.1 (2), and from the NCFPC Tables
1804.2.2.1, 1805.2.2, 2703.1.1(1), 2703.1.1 (2), 3304.3, 3404.3.4.1, 3405.3.8.2. This information is required before the designer can determine even the most basic Code requirements for a building including its Occupancy Classification, the Type of Construction permitted by Code, and whether or not the building must be sprinklered or have other types of special suppression, exhaust, monitoring and alarm, or electrical systems.

1st Floor - 100% of Allowable Quantities

<table>
<thead>
<tr>
<th>Total per classification</th>
<th>abbrev.</th>
<th>Exempt Quantity Storage</th>
<th>Code Exempt Quantity Storage with sprinkler/ storage</th>
<th>Exempt Use-closed</th>
<th>Code Exempt Use-closed with Sprinkler/ storage</th>
<th>Exempt Use Open</th>
<th>Code Exempt Use Open with Sprinkler/ storage</th>
<th>U/M</th>
<th>Actual Quantity *red-denotes exceeds exempt quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II Combustible Liquid</td>
<td>CL-2</td>
<td>120</td>
<td>480</td>
<td>120</td>
<td>240</td>
<td>30</td>
<td>60</td>
<td>gal</td>
<td>12</td>
</tr>
<tr>
<td>Class IIIA Combustible Liquid</td>
<td>CL-3A</td>
<td>330</td>
<td>1320</td>
<td>330</td>
<td>660</td>
<td>80</td>
<td>160</td>
<td>gal</td>
<td></td>
</tr>
<tr>
<td>Class IIIB Combustible Liquid</td>
<td>CL-3B</td>
<td>13200</td>
<td>UL</td>
<td>13200</td>
<td>UL</td>
<td>3300</td>
<td>UL</td>
<td>gal</td>
<td></td>
</tr>
<tr>
<td>Combustible Fiber ( Loose)</td>
<td>CFBRIL</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>20</td>
<td>20</td>
<td>cu.ft</td>
<td></td>
</tr>
<tr>
<td>Combustible Fiber ( Baled)</td>
<td>CFBRBB</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>200</td>
<td>200</td>
<td>cu.ft</td>
<td></td>
</tr>
<tr>
<td>Cyrogenic Flammable</td>
<td>CRYOF</td>
<td>45</td>
<td>90</td>
<td>45</td>
<td>90</td>
<td>10</td>
<td>20</td>
<td>gal</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3- Example of Allowable quantities for 1st floor (grade level)

a. Based on the information provided and obtained through preparation of the worksheets, the designer and the CEO are able to determine whether or not the material will exceed the allowable exempt quantities per control area or building. If so, the designer will then adjust the design accordingly and explain in the evaluation how the material will be handled in the building. For example, the building can be classified as a Hazardous Occupancy and designed accordingly, or part of the building can be classified as a Hazardous Occupancy and separated accordingly with fire barriers, or the building can be further broken down into control areas with smaller amounts in each control area to the extent that the building is no longer classified as a Hazardous Occupancy.

2nd Floor - 75% of Allowable Quantities

<table>
<thead>
<tr>
<th>Total per classification</th>
<th>abbrev.</th>
<th>Exempt Quantity Storage</th>
<th>Code Exempt Quantity Storage with sprinkler/ storage</th>
<th>Exempt Use-closed</th>
<th>Code Exempt Use-closed with Sprinkler/ storage</th>
<th>Exempt Use Open</th>
<th>Code Exempt Use Open with Sprinkler/ storage</th>
<th>U/M</th>
<th>Actual Quantity *red-denotes exceeds exempt quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II Combustible Liquid</td>
<td>CL-2</td>
<td>50</td>
<td>300</td>
<td>50</td>
<td>100</td>
<td>22.5</td>
<td>45</td>
<td>gal</td>
<td>12</td>
</tr>
<tr>
<td>Class IIIA Combustible Liquid</td>
<td>CL-3A</td>
<td>247.5</td>
<td>900</td>
<td>247.5</td>
<td>90</td>
<td>40</td>
<td>80</td>
<td>gal</td>
<td></td>
</tr>
<tr>
<td>Class IIIB Combustible Liquid</td>
<td>CL-3B</td>
<td>9000</td>
<td>UL</td>
<td>9000</td>
<td>UL</td>
<td>4000</td>
<td>UL</td>
<td>gal</td>
<td></td>
</tr>
<tr>
<td>Combustible Fiber ( Loose)</td>
<td>CFBRIL</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>15</td>
<td>15</td>
<td>cu.ft</td>
<td></td>
</tr>
<tr>
<td>Combustible Fiber ( Baled)</td>
<td>CFBRBB</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>159</td>
<td>cu.ft</td>
<td></td>
</tr>
<tr>
<td>Cyrogenic Flammable</td>
<td>CRYOF</td>
<td>33.75</td>
<td>67.5</td>
<td>33.75</td>
<td>67.5</td>
<td>7.5</td>
<td>15</td>
<td>gal</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4- Example of Allowable quantities for 2nd floor (1st level above grade)

b. Another possible alternative might be to purchase a hazardous materials storage unit and store the material or materials in a secure area outside the...
building. There are certain conditions when a detached storage building is required. See NCFPC, Sections 2703.8.1 and 2703.8.2.

c. It is sometimes confusing to determine which percentage of allowable quantities to use from NCBC Table 414.2.2 based on location within the building. The term grade plane is defined in 2012 NCBC Section 502. Above grade plane is regarded to be above ground and below grade plane to be below ground. So the 1st floor level above grade plane would be the first floor, ground floor or entrance floor of the building. The 1st floor level below grade plane would be the first floor below the entrance or 1st floor of the building. So it follows that the ground floor or 1st floor of a building would be allowed to contain 100% of the allowable quantities as it would be the quickest floor to evacuate, as it should lead directly to the outside. As you travel further up or down into the building away from the ground floor, the quantities are reduced respective to the length of time it would take to evacuate those floor levels.

3. Also indicate on the plans and report, the types of mechanical systems in the building including where duct work is located, protection of ducts, and where heating/cooling units are located. The locations of these systems are important to determine alternate methods, if necessary, to achieve code compliance.

4. Containers for materials may also be marked with NFPA placards (figure 5). These placards provide information in a visual format about the materials (figure 6).

These code regulations were created to help prevent the injuries, illnesses, deaths, medical costs, and fires caused by hazardous materials.

5.0 Inspections

A. The introduction of a hazardous material can be detrimental to the overall safety of a building after the structure has been completed. This complication is common in buildings where new tenants can potentially affect the classification of the entire building and other tenants. The situation may be alleviated by rated separation assemblies, storage quantities and storage arrangements. For example, a building originally designed to be a drug store is later occupied by a store that carries pool chemicals and supplies. There are several different varieties of chlorine that can be used to disinfect swimming pool water. The most common type of chlorine for that purpose is calcium hypochlorite, which is classified as a class 3 solid oxidizer, class 1 unstable reactive and class 1 water reactive. This material is limited to a storage quantity of 10 lbs. without necessitating other code considerations. In order to carry a larger supply for sale, modifications will be required for this building.

B. As required by the NCFPC, a current inventory of materials is to be kept on site and be available to Fire Inspectors during annual inspections. (NCFPC, section 2701.5.2) The risks associated with storing and handling these materials must be assessed continually to
ensure that changes in the materials on site or changes to the structure where they are stored are identified and minimum life safety measures prescribed by code are maintained. This includes minimizing the possibility of environmental damage caused by leaks and spills.

![Figure 6 - Explanation of NFPA Placard](Compliments of DuraLabel)

Current 2012 Codes reference the 2007 edition of NFPA 704, however no significant changes have been made to the placard since 1996.

### 6.0 Resources

A. **HMEX** - The Hazardous Material Expert Assistant Software Program

B. **NFPA** – National Fire Protection Association Hazardous materials site
C. **EPA** – Environmental Protection Agency- Hazardous Material site
D. **NCDA** – North Carolina Department of Agriculture- pesticide site
E. **OSHA**- Hazardous material site
F. **NFPA 400** – NFPA Hazardous Material Code
G. Click here for Free [NFPA 704 marking guide](#) –
I. **FAQ’s- NFPA 704** – why use NFPA 704?
J. **MSDS Solutions** -
K. Free [MSDS site](#)-Global Provider of Chemical, Regulatory and Compliance Information Services
L. **North Carolina Association of Hazardous Material Responders** organization that serves as the focal point in North Carolina for hazardous materials responders from all emergency services disciplines, the private sector, and those persons with an interest in hazardous materials response

### 7.0 Appendix A - Definitions (excerpts from NCFPC)

A. *Closed Container (Vessel):* A container sealed by means of a lid or other device such that liquid, vapor or dusts will not escape from it under ordinary conditions of use or handling.

B. *Closed System:* The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of *compressed gases.* Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

C. *Combustible Liquid:* A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:
   1. Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C). Examples are kerosene, diesel.
   2. Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C). Examples are # 2 or 3 fuel oil.
   3. Class IIIB. Liquids having closed cup flash points at or above 200°F (93°C). Examples are lubrication oil, # 4, 5, or 6 fuel oil.

   The category of combustible liquids does not include *compressed gases* or *cryogenic fluids.*

D. *Compressed Gas:* (see also cryogenic fluids) A material, or mixture of materials which:
   1. is a gas at 68°F (20°C) or less at 14.7 psia (101 kPa) of pressure; and
   2. has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health-
or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (28 kPa) at 68°F (20°C).

3. Examples are helium, argon, neon, acetylene, carbon monoxide.

E. **Container:** A vessel of 60 gallons (227 L) or less in capacity used for transporting or storing hazardous materials. Pipes, piping systems, engines and engine fuel tanks are not considered to be containers.

F. **Control Area:** Spaces within a building where quantities of hazardous materials not exceeding the *maximum allowable quantities* per control area are stored, dispensed, used or handled. See also the definition of “Outdoor control area.”

G. **Corrosive:** A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR173.137, such chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces. Examples are ammonia, fluorine.

H. **Cryogenic Fluid:** A fluid having a boiling point lower than -130°F (-89.9°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101.3 kPa). Cryogenic fluids will exist as *compressed gases* when they are stored at ambient temperatures. Examples are carbon monoxide, hydrogen, methane, xenon.

I. **Dispensing:** The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

J. **Flammable Liquid:** A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

1. Class IA. Liquids having a flash point below 73°F (23°C) and having a boiling point below 100°F (38°C). Examples are ether, turpentine.
2. Class IB. Liquids having a flash point below 73°F (23°C) and having a boiling point at or above 100°F (38°C). Examples are auto gasoline.
3. Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C). Examples are toluene, alcohol, methanol.

The category of flammable liquids does not include compressed gases or cryogenic fluids.

K. **Handling:** The deliberate transport by any means to a point of storage or use.

L. **Hazardous Materials:** Those chemicals or substances which are *physical hazards* or *health hazards* as defined and classified in Chapter 37 of the NC fire Code, whether the materials are in useable or waste condition.

M. **Hazardous Production Material (HPM):** A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes which have as their end product materials that are not hazardous.
N. **Health Hazard:** A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic, highly toxic and corrosive.

O. **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. Examples are arsine, cyanogen, nitric oxide phosphine.

P. **IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH).** The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m3). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the fire code official shall make such determination.

Q. **Incompatible Materials:** Materials that, when mixed, have the potential to react in a manner which generates heat, fumes, gases or byproducts which are hazardous to life or property.

R. **Inert gas:** A gas that is capable of reacting with other materials only under abnormal condition such as high temperature, pressures and similar extrinsic physical forces. Examples are argon, helium, neon, nitrogen.

S. **Lower Flammable Limit (LFL):** The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as LEL or lower explosive limit.

T. **Material Safety Data Sheet (MSDS):** Information concerning a hazardous material which is prepared in accordance with the provisions of DOL29 CFR Part 1910.1200 or in accordance with the provisions of a federally approved state OSHA plan.

U. **Maximum Allowable Quantities (MAQs):** The maximum amount of a hazardous material
allowed to be stored or used within a control area inside a building or an outdoor control area. The maximum allowable quantity per control area is based on the material state (solid, liquid or gas) and the material storage or use conditions.

V. Optional Permit: Operational permits listed as optional in NCFPC, Section 105.6 must be adopted by local ordinance to be legally issued by the fire code official. A permit listed as optional does not make any of the technical provisions of this code optional.

W. Outdoor Control Area: An outdoor area that contains hazardous materials in amounts not exceeding the maximum allowable quantities of NCFPC, Table 2703.1.1(3) or 2703.1.1(4).

X. Oxidizer: A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials. Examples of other oxidizing gases include bromine, chlorine and fluorine.

Y. Physical Hazard: A chemical for which there is evidence that it is a combustible liquid, cryogenic fluid, explosive, flammable (solid, liquid or gas), organic peroxide (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).

Z. Pressure Vessel: A closed vessel designed to operate at pressures above 15 psig (103 kPa).

AA. Pyrophoric: A chemical with an auto ignition temperature in air, at or below a temperature of 130°F (54°C). Examples are silane, diborane, phosphine.

BB. Safety Can: An approved container of not more than 5-gallon (19 L) capacity having a spring-closing lid and spout cover so designed that it will relieve internal pressure when subjected to fire exposure.

CC. 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.

   Examples are chlorine, hydrogen fluoride, phosgene.

DD. Unstable/Reactive: A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Examples are butadiene, ethylene oxide, vinyl chloride.
EE. *Use*: Placing a material into action, including solids, liquids and gases.

FF. *High-Hazard Group H*: High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of quantities allowed in control areas constructed and located as required in NCFPC, Section 2703.8.3.

Hazardous uses are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this code and the requirements of Section 415 of the International Building Code. The following 13 exceptions shall not be classified in Group H, but shall be classified in the occupancy that they most nearly resemble:

1. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 of the NCBC and the NCFPC.

2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the NCFPC.

3. Closed piping systems containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.

4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed as per Section 707 of the NCBC or 1-hour horizontal assemblies constructed as per Section 712 of the NCBC or both.

5. Cleaning establishments which utilize a liquid solvent having a flash point at or above 200°F.


7. Refrigeration systems.

8. The storage or utilization of materials for agricultural purposes on the premises.

9. Stationary batteries utilized for facility emergency power, uninterrupted power supply or telecommunication facilities provided that the batteries are provided with safety venting caps and ventilations is provided in accordance with the NCMC.

10. Corrosives shall not include personal or household products in their original packaging used in retail display or commonly used building materials.

11. Buildings and structures occupied for aerosol storage shall be classified as Group S-1, provided that such buildings conform to the requirements of the NCFPC.

12. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the
13. The storage of black powder, smokeless propellant and small arm primers in Group M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements of the NCFPC.

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