HAZARDOUS MATERIALS "OPINION AND REPORT" AND ITS REALTIONSHIP TO;

HAZARDOUS MATERIALS COMPLIANCE UNDER THE MICHIGAN/INTERNATIONAL BUILDING CODES

IBC, IMC, IPC, NEC, IFC, AND ALL REFERENCED STANDARDS *(authors note; this was written with the International Codes referenced, but also applies the Michigan Codes)*

PURPOSE: As Hazardous Materials are often overlooked in the design and construction process; the Purpose of this bulletin to assist the Design Professionals, Owners, Plans Examiners, Building Officials, Building Inspectors and various Trade Inspectors by describing their mandates under the Codes, where the authority comes from to request this report, examples of questions to ask, what the report should contain, what to do with the report once completed, thereby assuring a Safe and Code Compliant building and installation, in respect to Hazardous Materials.

- =Critical Statements
  - = Explanations/Questions
    - *Quotations from References/Codes*
      Underline= Important Key words

- **Hazardous Materials Compliance** is often misunderstood by many.

1. Misconception; thinking that as long as the "Fire Area/Control Area" contains quantities under the "MAQ" *(Maximum Allowable Quantity)* for each category, that this is all that is required.

2. Misconception; As long as the Code is silent on a specific chemical/process, there are no code Requirements.

3. Misconception; As long as the Code addresses the chemical that is used and the strict wording of the Code is complied with, that this is a Code Compliant Installation/use.

4. Misconception; As a Code Official I cannot or do not have to request anything that the Code does not address.

- Nothing could be further from the truth

- **Biggest mistake made** by any Code Official/Design Professional, is thinking that the Code provides a prescription (recipe) for every situation.

- **Performance language** in the Codes has to be recognized and utilized or catastrophes will happen.

  - Let us first understand how the Codes are meant to be used.

    a. The MOST IMPORTANT, but under utilized portion of the Codes are the Administration sections.
    b. These are sections that give the Code Official his/her authority and define responsibilities.
    c. These are rarely discussed in training/educational seminars.

- *Quote: IBC/MBC 101.3 Intent. The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.*

- *Quote: IMC/MMC 101.3 Intent. The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of mechanical systems.*

- *Quote; IMC/MMC 102.9 Requirements not covered by this code.*
  Requirements necessary for the strength, stability or proper operation of an existing or proposed mechanical system, or for the public safety, health and general welfare, not specifically covered by this code, shall be determined by the code official.

- *Quote: IBC/MBC 101.2 Scope.*
  The provisions of this code shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

- *Quote: IBC/MBC 101.4.5 Fire prevention.*
  The provisions of the International Fire Code shall apply to matters affecting or relating to structures, processes and premises from the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices; from conditions hazardous to life, property or public welfare in the occupancy of structures or premises; and from the construction, extension, repair, alteration or removal of fire suppression, automatic sprinkler systems and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.

- Authors note: Yes the entire fire Code is applicable to construction!!

- **To have a safe** *(if the Building and its processes within are not safe, it is not a Code compliant Building under the Intent of the Codes and responsibilities of the Building Official)* **and Code Compliant building** there are several considerations/questions that must be answered/addressed.

  - **Questions to ask**: some examples of these questions are:

1. What is the function of use of all spaces/areas in the building as well as around the outside of the building?
2. What is the description of the business?
3. What is the detailed description of each individual process inside and outside of the building(s)?
4. What chemicals/materials are used?
5. What chemicals are stored?
6. What are the quantities of the chemicals stored?
7. What are the quantities of the chemicals used?
8. Where are the chemicals stored?
9. Where are the chemicals used?
10. What type and size of containers are the chemicals stored in?
11. What are the quantities of the chemicals used in an open system?
12. What are the quantities of the chemicals used in a closed system?
13. Are any of the quantities of the chemicals over the MAQ?
14. Are there any chemicals that have specific code requirements even when the quantities are under the MAQ?
15. Are there any chemicals that have specific traits that require specific handling requirements/engineering control requirements or recommendations that are not mentioned by name in the Code, or if mentioned; have few details on how to handle safely?
16. Is hazardous exhaust (section 510 MMC IMC) required under the IFC and MMC/IMC? Provide calculations.
17. Are any chemicals sprayed onto any parts or during any processes?
18. What are any hazards present that are not addressed by the codes?
19. What features are needed to be incorporated into the design of the building and its systems to provide for a safe installation (code required and even non code required)?
20. Is dust generated during processing?
21. Are any dusts, fumes, mists or vapors that could be deemed either; irritating or injurious to health?
22. Are any of the materials powders that could possibly produce or be considered “Combustible Dust”?
23. Are there any chemicals/compounds/materials that do not have an IDLH value assigned or tested?
24. Are there any Combustible liquids that are/could be at a temperature near their flashpoint?
25. Are exhaust and ventilation rates consistent with *(American Council of Industrial Hygienists Ventilation Handbook)* industry standards?

- **Quote directly** from the **MBC/IFC 2012:** ***(414.1.2 MBC 2012)*** *Materials.*

The safe design of hazardous material occupancies is material dependent. Individual material requirements are also found in Sections 307 and 415, and in the International Mechanical Code and the International Fire Code. This is performance language!

❖ Author's commentary:

The safe design of hazardous material occupancies is also process and environmental condition dependent. Meaning; that an accurate process description and the actual environmental conditions that the materials are/may be exposed to are also crucial. Examples:

1. Are Flash/Boiling points adjusted for the actual elevation above sea level for the locations used?
2. Are Chemicals heated?
3. Are Chemicals pressurized?

(414.1.3 MBC 2012) Information required*.*

- *A report shall be submitted to the building official identifying the maximum expected quantities of hazardous materials to be stored,*
- *used in a closed system and*
- *used in an open system, and*
- *subdivided to separately address hazardous material classification categories based on Tables 307.1(1) and*
- *307.1(2).*
- *The methods of protection from such hazards,*
- *including but not limited to control areas,*
- *fire protection systems and*
- *Group H occupancies shall be indicated in the report and on the construction documents.*
- *The opinion and report shall be prepared by a qualified person, firm or corporation approved by the Building Official*

- **There are no prescriptive code requirements for the majority of chemicals/processes/installations**, as the Code cannot cover all things that present a health or safety risk to the occupants.

  - The following is an explanation of the above components required in the "*Opinion and Report"* (414.1.3 MBC/IBC 2012) and why the report is required.
    1. One reason the report is required is to demonstrate **Code compliance** for the particular installation/chemicals/processes at a particular facility. The Code is performance based relative to the "Intent" and the above code section. The code is not and cannot be prescriptive for all situations/chemicals/uses.

    2. Another purpose is to demonstrate a "***Safe Design"*** as required under "*intent," "scope"* and *"requirements not covered by this Code"* under the Michigan/International Building and Mechanical Codes.

The Required "*Opinion and Report"* Code language, as well as the "*intent"* (101.3 MBC 2012), *"scope"* (101.2 MBC 2012), "*Requirements not covered by this Code"* (102.9 MMC 2012)" are **performance based** language which is why the Code requires this *"Opinion and Report"* and further why the AHJ has to approve of the person, firm or corporation compiling the *"Opinion and Report"* to ensure the *"Opinion and Report"* is prepared by a *"Qualified Person Firm or Corporation".*

- **Qualifications: In order to ensure a thorough *"opinion and report"*** "*the qualified person firm or corporation"* must possess or have ready access to several areas of expertise.

  - Therefore in order for the AHJ (Authority Having Jurisdiction) to "qualify" a "*Person Firm or Corporation"* to perform these reports within their jurisdiction, the *"Person Firm or Corporation"* must possess (as applicable) knowledge of above all else: IMPARTIALITY, CODES and Industry Standard Practices:

  - The Qualified Person should have at least two plus years' experience as a PE or under the direct supervision of, in the subject matter at hand such as: Hazardous Area Construction, Refineries, Chemical Plants, Combustible Dusts, Flammable Vapor/Gas Detection, etc.

1. Principles of Fire Protection
2. Process Hazard Analysis
3. Risk Assessment
4. Chemistry, (Chemical Properties, Behaviors of the materials and outside factors)
5. Physics, (Physical Properties, Behaviors of the materials and outside factors)
6. Principles of Fire Protection as a whole, (not just suppression)
7. Principles of Ventilation and Exhaust, (how rates are calculated, including the vaporization rates of various materials at any expected temperatures)
8. Fluid Mechanics
9. Human Behavior in an Emergency, including exit modeling and some cases areas of refuge
10. Process Control
11. Industrial Hygiene
12. Codes and standards, (MBC, MMC, IFC, American Council of Industrial Hygienists Ventilation Handbook, FFRTKA, Industry Standards, NFPA Fire Protection Handbook, Compressed Gas Association, NFPA-numerous other references)

❖ Hazardous Materials *"Opinion and Report"* (414.1.3 MBC 2012)

❖ The contents of the report should consist of:

1. **A spread sheet containing:** The chemicals shall be classified in accordance with NFPA 704 (510.1 MMC 2012) and not some other regulatory standard. The complete list of chemicals in the building with maximum expected quantities, including where they are used and stored. This is likely written by the management of the business with assistance from the *"Approved person, firm or corporation". Classified by categories and subdivided separately to address all categories based on Tables (307.1(1) and 307.1(2) MBC 2012.*

   These spread sheets are usually requested in a certain format by the AHJ and contain the other useful information such as which process and pieces of equipment are used with which chemical, which control area in the building, open, closed or storage.

2. **Safety Data Sheets:** Required for each chemical in the building. IDLH information not completed in these sheets will need to be evaluated in accordance with the definition for "Immediately Dangerous To Life and Health" *(Independent certified Industrial Hygienist or industrial toxicologist*).

3. **Description of the business:** This is likely written by the management and the process specialist of the business with assistance from the *"Approved person, firm or corporation"*

4. **Description of each process in the building:** This is likely written by the management and the Process Specialist of the business with assistance from the "*Approved person, firm or corporation*".

5. **Code Compliance portion:** The code compliance analysis, details and narrative, citing Codes and Standards including Code sections. This is to be prepared by the "*Approved person, firm or corporation*".

6. **The "*Opinion"* portion:** with analysis and narrative, describing *"methods of protection"* details required for a safe installation (over and above the code requirements or where code requirements are unclear), citing sources. This is to be prepared by the "*Approved person, firm or corporation*".

7. **Executive Summary portion:** Include any major items that will affect the design of the project and summarize the areas that need correction, only without all of the details. It will contain general statements such as:

    a. Ventilation system will have to supply a higher outdoor air and or exhaust rate, see applicable Codes and sections, Industry guidelines, standards, Industry Best Practices. _____, _____, _____
    b. Hazardous Material transport routes within the building.
    c. Source capture exhaust will be required in the following areas,
    d. The exhaust system will need to be treated as a hazardous exhaust system in accordance with section 510 of the MMC,
    e. Provide all required items as relating to Hazardous exhaust on the construction documents.
    f. Fugitive dust will need to be substantially reduced by additional source capture equipment or this will have to be considered an H occupancy classification.
    g. Compliance with: NFPA-77 for Recommended Practice on Static Electricity is required to be demonstrated.
    h. Compliance with: NFPA 91 Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Non-Combustible Particulate Solids, shall be demonstrated.
    i. Conformance to applicable requirements of NFPA 30-A Code for Motor Fuel Dispensing Facilities and Repair Garages, shall be demonstrated.
    j. Additional fire department access doors will have to be added to comply with section _____of the IFC,
    k. Oxidizers and flammable and combustible materials and flammable and combustible liquids will require a minimum of __ ft separation aisles. Incompatible Materials storage requirements,
    l. Highly toxic materials exhausted will require approved scrubbers for the exhaust. This is to be prepared by the, Industrial Hygienist/Specialist.
    m. The use of the Perchloric acid requires a dedicated fume/vapor exhaust, which is a hazardous exhaust system and to be installed in accordance with Harvard Universities requirements for Perchloric Acid hoods, exhaust and handling.

❖ What to do with the Report once prepared?

1. The report must then be presented to the *"Registered Design Professional in Charge*" (IBC/MBC 2012 107.3.4) who will incorporate the recommendations and "*Methods of Protection*" into the design of the building and its systems. (Simultaneously a courtesy copy goes to the AHJ)
2. At this point the "*Opinion and Report",* "*revised construction documents"* and "*shop drawings"* will be signed and sealed along with a notation "*This report was reviewed and found to be in conformance with the design of the building"* and to be treated as a "*deferred submittal"* (IBC/MBC 2012 107.3.4.1) submitted to the AHJ for review and approval or rejection.

❖ "*Methods of protection"* Provide for the safe built environment.

- In order to fulfill the second half of the report requirements; (providing a safe installation) *"methods of protection"* need to be determined and spelled out in the report. These *"methods of protection"* are frequently over and above what the code prescribes, and are the *"opinion and report"* writers personal judgment based upon; science, industry best practices, "standard of care", specific research and personal experience.

- *"Methods of protection"* could be: anything, Emergency Alarm Systems, Leak Detection, Emergency Shutoff, Water Wash air filtration, Explosion Venting, Explosion Control, Ventilation Monitoring, Vapor Detection, Gas Detection, Battery Backup, Containment, Emergency Purging of Piping, Hazardous Exhaust Duct Requirements, Special Piping Requirements, Signage, Aisle Widths, Paint Kitchens, Shortened Egress Routes, Control Areas, Cut Off Rooms, Storage Arrangements, Storage Cabinets, Approved Storage Containers, Humidity Control, Temperature Controlled Rooms, Fire Department Access Doors, etc.

- Often one will consult with other subject matter experts and or technical publications/reports form sources such as US Chemical Safety Board, NIST, OSHA, NIOSH, Fire Fighters Right to Know Act, Specialty Consultants, NIBS, FEMA, Smithsonian Institute, Harvard and other Universities.

RELATED DEFINITIONS

AEROSOL. A product that is dispensed from an aerosol container by a propellant. Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2 or Level 3. [F]

> **Level 1** aerosol products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb).
>
> **Level 2** aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb, but less than or equal to 13,000 Btu/lb.
>
> **Level 3** aerosol products. Those with a total chemical heat of combustion that is greater than 13,000 Btu/lb .

APPROVED. Acceptable to the building official or authority having jurisdiction.

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" in the International Fire Code.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F. Combustible liquids shall be subdivided as follows:

> **Class II.** Liquids having a closed cup flash point at or above 100°F and below 140°F.
>
> **Class IIIA.** Liquids having a closed cup flash point at or above 140°F and below 200°F.
>
> **Class IIIB.** Liquids having a closed cup flash point at or above 200°F.
>
> The category of combustible liquids does not include compressed gases or cryogenic fluids.

COMBUSTIBLE DUST. Finely divided solid material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a U.S. No. 40 standard sieve.

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.

EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving hazardous materials.

GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

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 or highly toxic, and corrosive.

HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration that 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 1 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.

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of air-borne contaminants which 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 (ppmv/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 building official shall make such determination.

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

INERT GAS. A gas that is capable of reacting with other materials only under abnormal conditions such as high temperatures, pressures and similar extrinsic physical forces. Within the context of the code, inert gases do not exhibit either physical or health hazard properties as defined (other than acting as a simple asphyxiant) or hazard properties other than those of a compressed gas. Some of the more common inert gases include argon, helium, krypton, neon, nitrogen and xenon.

LIQUID USE, DISPENSING AND MIXING ROOM. A room in which Class I, II and IIIA flammable or combustible liquids are used, dispensed or mixed in open containers.

OPEN SYSTEM. The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

ORGANIC PEROXIDE. An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

> **Class I.** Those formulations that are capable of deflagration but not detonation.
>
> **Class II.** Those formulations that burn very rapidly and that pose a moderate reactivity hazard.
>
> **Class III.** Those formulations that burn rapidly and that pose a moderate reactivity hazard.
>
> **Class IV.** Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.
>
> **Class V.** Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and, if heated or contaminated, can result in vigorous self-sustained decomposition.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Additionally, the oxidizer causes a severe increase in the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes in contact.

Class 2. An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes in contact.

Class 1. An oxidizer that does not moderately increase the burning rate of combustible materials.

OXIDIZING GAS. A gas that can support and accelerate combustion of other materials more than air does.

PYROPHORIC. A chemical with an auto-ignition temperature in air, at or below a temperature of 130°F.

PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

STORAGE, HAZARDOUS MATERIALS. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

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.

UNSTABLE (REACTIVE) MATERIAL. 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.

Unstable (reactive) materials are subdivided as follows:

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

USE (MATERIAL). Placing a material into action, including solids, liquids and gases.

WATER-REACTIVE MATERIAL. A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that react violently with water or have the ability to boil water. Materials that produce flammable, toxic or other hazardous gases or evolve enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture.

Class 1. Materials that react with water with some release of energy, but not violently.

Case study Perchlorates/Perchloric acid

Perchloric acid is addressed by the MMC/IMC only relative to the exhaust manifolding requirements.

Perchloric acid is addressed by the MBC/IBC/IFC relative to: explosive, reactive hazards only based upon the accuracy of the GHS Safety Data Sheets.

Perchloric acid is NOT ADDRESSED prescriptively in the Codes as to many other safety criteria necessary for a safe installation.

Therefore this chemical is used primarily in Laboratories, so we can and shall consult with the NFPA Standard on Laboratory's Using Chemicals as well as Harvard Universities Safety policy for the Use of Perchloric Acids.

Combustible liquids example:

A fluid used as a heat transfer fluid that is heated under pressure close to or above its flashpoint is an extreme hazard. This hazardous material as utilized in a testing/R&D application can actually become a flammable vapor/mist rather than its initial classification of a combustible liquid. This would require "Methods of protection to be designed specifically for this application by a process safety engineer or equivalent.

WE APPROVE ##### ####### OF ########## CODE Consulting TO PREPARE THE HAZARDOUS MATERIALS OPINION AND REPORT, THE REPORT WILL BE REQUIRED TO BE SUBMITTED BY A STATE LICENSED ENGINEER, WITH A STATEMENT OF ACCEPTANCE , SIGNED AND SEALED, WITH ANY RECOMENDATIONS INCORPORATED INTO THE DESIGN OF THE BUILDING AND ITS SYSTEMS.