NFPA 99 and Engineering Concerns

"Battle of

Medical Gas, NFPA 99, UFC, AIA"

September 11th, 2013

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List is available at **Facebook**: **Saum Greenerade**

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"The Battle of"

Medical Gas, NFPA 99, AIA, and Plumbing Codes

Segments

A. Basics of Gas Chemistry/Physics
B. Medical Gas

A. Basics of Gas Chemistry/Physics

Introduction
If you study chemistry and matters, you will easily bump into these chapters in the book that deals with intra and intermolecular forces with gases, the gas laws (Ideal, Charles, and Boyle, Avagadro), the density, the Dalton's law of partial pressure, grahams' law of diffusion and effusion.

Without taking the reader to a four month Journey in Chemistry, the basics needed to understand NFPA 99 and Plumbing Codes.

Fundamentals of Gas Laws
On earth the matter is subdivided into three categories, solids, with fixed volume and weight occupying known boundaries, the liquid, where the boundaries must be contain in an open container, and gas, where the boundaries are defined within a closed container.

The Gas Laws
The nature of gas can be determined with a simple gas law. We need to assume that gases are ideal and not "real".

Ideal Gases
Based in ideal gas assumption, the following properties.

- All random motions of gas particles are in constant motion,
- The conservation of energy on impact of the gas particle holds true. All particles are elastic.
- All gas molecules do not hat attractive or repulsive interactions based on magnetic field.
- The average kinetic energy of gas is proportional to its temperature, where all molecules have same temperature.

The property of gases are simple: Temperature, T (Kelvin), volume, V, and pressure, P. Based on quantity (n=number of moles). A reference STP stands for Standard temperature and pressure at 273 degrees K (or zero degree Celsius) and one atmosphere.

In an Ideal gas law, the equation can be written as:

$$PV=nRT$$

P is the absolute gauge pressure, T is in Kelvin, n is the number of molecules, R is a constant, and V is the volume.

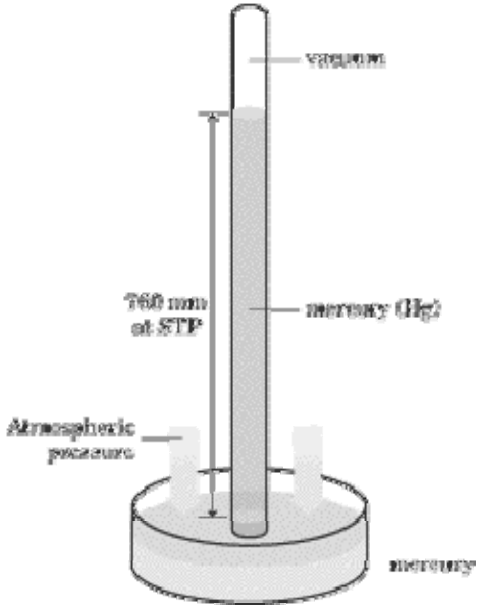
Pressure:

Measuring the Pressure of a Gas

Gas pressure is a gauge of the number and force of collisions between gas particles and the walls of the container that holds them. The SI unit for pressure is the Pascal **Pa)**, but other pressure terms include **atmospheres atms)**, **millimeters of mercury (mmHg)**, and **torr**. The following is a list of all of the standard pressure in every unit for pressure. Memorize these for the exam so you can convert units where necessary:

760 mmHg
760 torr
1.00 atm
101,325 Pa
101.325 kPa

The piece of lab equipment specifically designed to measure the pressure of gases is known as the barometer. A **barometer** uses the height of a column of mercury to measure gas pressure in millimeters of mercury or torr (1 mmHg = 1 torr). The mercury is pushed up the tube from the dish until the pressure at the bottom of the tube (due to the mass of the mercury) is balanced by the atmospheric pressure.



When using a barometer, you calculate gas pressure with the following equation:

Gas pressure = atmospheric pressure - ***h*** (height of the mercury)

The **open-tube manometer** is another device that can be used to measure pressure. The open-tube manometer is used to measure the pressure of a gas in a container.

The pressure of the gas is given by *h* (the difference in mercury levels) in units of torr or mmHg. Atmospheric pressure pushes on the mercury from one direction, and the gas in the container pushes from the other direction. In a manometer, since the gas in the bulb is pushing more than the atmospheric pressure, you add the atmospheric pressure to the height difference:

$$\text{gas pressure} = \text{atmospheric pressure} + h$$

There is one other possibility for a manometer question that could appear on the SAT II Chemistry test: they could ask you about a **closed-tube manometer**. Closed-tube manometers look similar to regular manometers except that the end that's open to the atmospheric pressure in a regular manometer is sealed and contains a vacuum. In these systems, the difference in mercury levels (in mmHg) is equal to the pressure in torr.

Boyle's Law

Boyle's law is simply when in an experiment the temperature and number of molecules are constant, where the ideal gas law equation is simplified to:

PV = Constant. Boyles' Law

As the pressure increases, the volume reduces and as the volume increases, the pressure decreases. This inverse proportionality of pressure and volume is known as Boyles Law. In an enclosed balloon, as the volume increases, the pressure decreases.

Boyles law between two states can be written as:

$P_1V_1 = P_2V_2$ Boyles' Law

Where the 1 and 2 identifies the properties of gas in state 1 and in state 2.

Charles's Law

Charles's law is similar to Boyles law where one property remains constant, the pressure and number of molecules. Ideal gas law equation reduces to:

V/T= Constant Charles' Law

In Charles' law the relation between the temperature and volume is directly proportional. That is if temperature increases, the volume will increase. The ideal gas law between two gas state becomes:

V1/T1= V2/T2 Charles' Law

Medical Gas - UPC

Types of Medical Gases are based on their use:

- To Heal or therapeutic gases,
- To Experiment or laboratory gases, and
- To Surgery or anesthesia

The methods of creating gases are different from products to products, for example for oxygen production, methods to Manufacture O_2 are:

- Fractional Distillation, Electrolysis of H_2O, Chemical Decomposition, Physical Separation
- Fractional Distillation
- cheapest and most common method to manufacture O_2: air is filtered to remove pollutants, H_2O and CO_2. air is then liquefied by compression and cooled by rapid expansion. the resulting mixture is heated in a distillation tower and then transferred to cryogenic storage cylinders
- Electrolysis of H_2O
- separates oxygen from water

- Chemical Decomposition
- heating of oxygen to remove impurities
- Physical Separation
- uses oxygen concentrators to extract oxygen from ambient air; produces the least amount of oxygen

A Comprehensive table for Medical Gas piping:

Medical Gas and Fluid

Gas	Color/ Pressure	Odor	Taste	Chemical Composition	flammable	Application, minimum flow rate: Note 1- Any room designed for a permanently located respiratory ventilator or anesthesia machine shall have an outlet capable of a flow rate of 180 LPM (6.36 CFM) at the station outlet.	Col
Air (AIR), Medical Air, Med Air	Colorless 50–55 psi	Odorless	Tasteless	78% nitrogen, 21% oxygen, and 1% trace elements.		.71 CFM per outlet1	yello
Oxygen (O_2)	Colorless 50–55 psi	Odorless	Tasteless	21% of the earth's atmosphere; Liquid oxygen exists at cryogenic temperature, -300ºF at atmospheric pressure. When warmed expand to fill a volume 860 times its liquid volume.	not flammable but does support combustion	respiratory therapy and anesthesia, .71 CFM per outlet1 (20 LPM)	Gree white
Carbon Dioxide (CO_2)	Colorless 50–55 psi	Odorless	Tasteless		does not support combustion or life.	Occasionally used for surgical procedures and laboratory applications, 0.71 CFM per outlet1	Gray/ gray/
Helium (He)	Colorless 50–55 psi	Odorless	Tasteless	heliox in a 80/20 or a 70/30 mixture		.71 CFM per outlet	Brow
Nitrogen (N2)	Colorless 160–185 psi	Odorless	Tasteless	78% of the earth's atmosphere		pipe joining and pressure testing purposes, to power instruments, 15 CFM (0.42 m3/min.) free air per outlet	Blacl

Nitric Oxide (NO)	Colorless 50 55 psi	Faint Odor	Faint Taste			a vasodilator and used more in the neonatal unit	black
Nitrous Oxide (N_2O)/Oxide of Nitrogen	Colorless / 50 to 60 psig	Odorless/ "sweetish" smell	Tasteless	Exists as a gas at atmospheric conditions		used as an anesthetic, Capable of producing the first and second stages of anesthesia when inhaled, Oxygen is released under conditions of combustion, creating an oxygen-enriched atmosphere, .71 CFM per outlet	light
Oxygen/carbon dioxide mixture O2CO2n (n is % of CO2)	50-55 psi						Gree
Waste Anesthesia Gas Disposal (WAGD)				as "scavenging" or" evacuation		capture and carry away gases vented from the patient breathing circuit during the normal operation of gas anesthesia or analgesia equipment; can be connected to the medical surgical vacuum system under certain conditions but discouraged.	Viole
Medical Air (MA)	50 to 60 psig			The quality of the local ambient air should be considered prior to its selection for compressors and treatment equipment.		Medical air is supplied from cylinders, bulk containers, medical air compressors and treatment equipment, or has been reconstituted from oxygen and nitrogen; Exclusively used for human respiration or calibration of devices for respiratory application; Primarily used for respiratory therapy; Hydrocarbon carryover from the compressor poses a threat to the end user and increases the risk of fire especially when mixed with oxygen; A medical air compressor is designed to exclude oil from the airstream and compression chamber and that does not under normal operating conditions, or any single fault, add any toxic or flammable contaminants to the compressed air.	

Instrument Air (IA)	200 psig			Substitute for nitrogen for powering instruments unrelated to human;		respiration (surgical tools, ceiling arms, etc.); Medical air and instrument air are distinct systems for mutually exclusive applications.	
Medical Vacuum (MV)	15" to 30" Hg			An assembly of central vacuum producing equipment and a network of piping for patient suction in medical, medical-surgical, and waste anesthetic gas disposal(WAGD) applications		Primarily used for patient treatment in surgery, recovery, and ICU to remove fluids and aid in drainage.1 SCFM (0.03 sm3/min.) per inlet. For testing and certification purposes, individual station inlets shall be capable of a flow rate of 3 SCFM, while maintaining a system pressure of not less than 12 inches (305 mm) at the nearest adjacent vacuum inlet.	Whit
Nonmedical air (level 3 gas-powered device)							Yello diago
Nonmedical and Level 3 vacuum							Whit diago boxe
Laboratory air							Yello checl
Laboratory vacuum							Whit checl boxe
Other mixtures				Gas A%/ Gas B%			Colo gas f mino
Instrument air	160–185 psi						Red/

The Other code is the Uniform Plumbing Code, Chapter 13 that controls the medical gas design and installation.

Table 13-3 MINIMUM OUTLETS/INLETS PER STATION						
LOCATION	OXYGEN	MEDICAL VACUUM	MEDICAL AIR	NITROUS OXIDE	NITROGEN	HE
[4.] Vacuum inlets required are in addition to any inlets used as part of a scavenging system for remo anesthetizing gases.						
Patient rooms for medical/surgical, obstetrics, and pediatrics	1/bed	1/bed	1/bed	—	—	—
Examination/treatment for nursing units	1/bed	1/bed	—	—	—	—
Intensive care (all)	3/bed	3/bed	2/bed	—	—	—
Nursery- Includes pediatric nursery.	2/bed	2/bed	1/bed	—	—	—
General operating rooms	2/room	3/room[4]	2/room	1/room	1/room	—
Cytoscopic and invasive special procedures	2/room	3/room[4]	2/room	—	—	—

Recovery delivery and labor/delivery/recovery rooms- Includes obstetric recovery.	2/bed	2/bed	1/bed	—	—	—
	2/room	3/room[4]	1/room			
Labor rooms	1/bed	1/bed	1/bed	—	—	—
First aid and emergency treatment- Emergency trauma rooms used for surgical procedures shall be classified as general operating rooms.	1/bed	1/bed[4]	1/bed	—	—	—
Autopsy	—	1/station	1/station	—	—	—
Anesthesia workroom	1/station	—	1/station	—	—	—

TABLE 13-5 OUTLET RATING FOR VACUUM PIPING SYSTEMS				
	FREE-AIR ALLOWANCE, EXPRESSED AS CFM (LPM) AT 1 ATMOSPHERE		ZONE ALLOWANCES CORRIDORS-RISERS MAIN SUP	
LOCATION OF MEDICAL-SURGICAL VACUUM OUTLETS	PER ROOM	PER OUTLET	SIMULTANEOUS USAGE, FACTOR PERCENT	AIR TO BE TRANSPORTED CFM (LPM)
Operating Rooms				
Major "A" (Radical, Open Heart)	3.5 (99.1)	–	100	3.5 (99.1)
(Organ Transplant)	3.5 (99.1)	–	100	3.5 (99.1)
(Radical Thoracic)	3.5 (99.1)	–	100	3.5 (99.1)
Major "B"(All Other Major ORs)	2.0 (56.6)	–	100	2.0 (56.6)
Minor	1.0 (28.3)	–	100	1.0 (28.3)
Delivery Rooms	1.0 (28.3)	–	100	1.0 (28.3)
Recovery Rooms (Post-Anesthesia) and Intensive Care Units (a minimum of 2 outlets per bed in each such department)				
1st outlet at each bed	–	3.0 (85.0)	50	1.5 (42.5)
2nd outlet at each bed	–	1.0 (28.3)	50	0.5 (14.2)
3rd outlet at each bed	–	1.0 (28.3)	10	0.1 (2.8)
All others at each bed	–	1.0 (28.3)	10	0.1 (2.8)
Emergency Rooms	–	1.0 (28.3)	100	1.0 (28.3)
Patient Rooms				
Surgical	–	1.0 (28.3)	50	0.5 (14.2)
Medical	–	1.0 (28.3)	10	0.1 (2.8)
Nurseries	–	1.0 (28.3)	10	0.1 (2.8)
Treatment and Examining Rooms	–	0.5 (14.2)	10	0.05 (1.4)
Autopsy Area	–	2.0 (56.6)	20	0.4 (11.3)
Inhalation Therapy, Central Supply and Instructional Areas	–	1.0 (28.3)	10	0.1 (2.8)

B. Codes and Categories

C. **2010 Triennial Edition (current code)**

D. The 2010 triennial edition of Title 24, California Code of Regulations (CCR) consists of the following 12 parts:

E. • Part 1 - California Building Standards Administrative Code
o Downloadable (PDF)

F. • Part 2 - California Building Code

G. • Part 2.5 - California Residential Building Code

H. • Part 3 - California Electrical Code

I. o Link to NFPA Codes & Standards

J. • Part 4 - California Mechanical Code

K. • Part 5 - California Plumbing Code

L. • Part 6 - California Energy Code - Downloadable (PDF)

M. • Part 7 - (No longer published in Title 24. See Title 8, CCR)

N. • Part 8 - California Historical Building Code
o Downloadable (PDF)

O. • Part 9 - California Fire Code

P. • Part 10 - California Existing Building Code

Q. • Part 11 - California Green Building Standards Code (CALGreen

Code)

- Downloadable (PDF)
- Guide to CALGreen (PDF)

R. • Part 12 - California Reference Standards Code
- Downloadable (PDF)

S. **Published Supplements and Errata (current code)**
Supplements and Errata to the provisions of Title 24 are published by the code publishers. There are three publishers of the Parts of Title 24 with recently adopted revisions. Supplements are posted on their websites as follows:

T. For Parts 1, 2, 2.5, 6, 8, 9, 10, 11, and 12, (2010 Edition) the publisher is the International Code Council (ICC).
View Supplements and Errata on the ICC website.

U. For Parts 4 and 5 (2010 Edition), the publisher is the International Association of Plumbing and Mechanical Officials (IAPMO).
View Supplements and Errata on the IAPMO website.

V. For Part 3 (2010 Edition), the publisher is BNi Publications (BNi).
View Supplements and Errata on the BNi website.

Edition to display: 2012

What is NFPA 99?

1. NFPA 99 is now a “Code” – no longer just a “Standard”.
2. As such it is on an equal level with –i.e. NFPA 70, National Electric Code (NEC), NFPA1 Fire Code and NFPA 101 Life Safety Code.

NFPA 99 establishes criteria for levels of health care services or systems based on risk to the patients, staff, or visitors in health care facilities to minimize the hazards of fire, explosion, and electricity. Official document scope

NFPA® 99 Health Care Facilities Code 2012 Edition

The scope of this code is to establish minimum criteria

Chapter 1 Administration
1.1 Scope
1.2 Purpose
1.3 Application
1.4 Equivalency
1.5 Units
1.6 Code Adoption Requirements

Chapter 2 Referenced Publications
2.1 General
2.2 NFPA Publications
2.3 Other Publications
2.4 References for Extracts in Mandatory Sections

Chapter 3 Definitions
3.1 General
3.2 NFPA Official Definitions
3.3 General Definitions
3.4 BICSI Definitions

Fundamentals.

Chapter 4 establishes criteria for levels of health care services or systems based on risk to the patients, staff, or visitors in health care facilities.

Chapter 4 Fundamentals
4.1 Building System Categories
4.2 Risk Assessment
4.3 Application

Gas and Vacuum Systems.
Chapter 5 covers the performance, maintenance, installation, and testing of the following:
(1) Nonflammable medical gas systems with operating pressures below a gauge pressure of 2068 kPa (300 psi)
(2) Vacuum systems in health care facilities
(3) Waste anesthetic gas disposal (WAGD) systems, also referred to as scavenging

(4) Manufactured assemblies that are intended for connection to the medical gas, vacuum, or WAGD systems (also referred to as scavenging)

Requirements for portable compressed gas systems are covered in Chapter

Chapter 5 Gas and Vacuum Systems
5.1 Category 1 Piped Gas and Vacuum Systems
5.2 Category 2 Piped Gas and Vacuum Systems
5.3 Category 3 Piped Gas and Vacuum Systems

Electrical Systems.
Chapter 6 covers the performance, maintenance, and testing of electrical systems (both normal and essential) in health care facilities. 1.1.4.2 The following areas are not addressed in this code, but are addressed in

other NFPA documents:
(1) Specific requirements for wiring and installation of equipment are covered in NFPA 70, National Electrical Code.
(2) Requirements for illumination and identification of means of egress in health care facilities are covered in NFPA 101, Life Safety Code.
(3) Requirements for installation, testing, and maintenance of fire protection signaling systems are covered in NFPA 72, National Fire Alarm and Signaling Code.
(4) Requirements for installation of fire pumps are covered in NFPA 20, Standard for the Installation of Stationary Pumps for Fire protection, except that the alternate source of

power are permitted to be the essential electrical system.
(5) Requirements for installation of stationary engines and gas turbines are covered in NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

Chapter 6 Electrical Systems
6.1 Applicability
6.2 Nature of Hazards
6.3 Electrical System
6.4 Essential Electrical System Requirements — Type 1
6.5 Essential Electrical System Requirements — Type 2
6.6 Essential Electrical System Requirements — Type 3

Information Technology and Communications Systems.

Chapter 7 covers the performance, maintenance, and testing of information technology and communications systems in health care facilities.

Chapter 7 Information Technology and Communications Systems for Health Care Facilities
7.1 Applicability
7.2 Reserved
7.3 Category 1 Systems
7.4 Category 2 Systems
7.5 Category 3 Systems

Plumbing.
Chapter 8 covers the performance, maintenance, and testing of plumbing systems in health care facilities.

Chapter 8 Plumbing
8.1 Applicability
8.2 System Category Criteria
8.3 General Requirements

HVAC Systems.
Chapter 9 covers the performance, maintenance, and testing of heating, cooling, and ventilating in health care facilities.

Chapter 9 Heating, Ventilation, and Air Conditioning (HVAC)
9.1 Applicability
9.2 System Category Criteria
9.3 General

Electrical Equipment.
Chapter 10 covers the performance, maintenance, and testing of electrical equipment in health care facilities.

Chapter 10 Electrical Equipment
10.1 Applicability
10.2 Performance Criteria and Testing for Patient Care–Related Electrical Appliances and Equipment
10.3 Testing Requirements — Fixed and Portable
10.4 Nonpatient Electrical Appliances and Equipment
10.5 Administration

Gas Equipment.
Chapter 11 covers the performance, maintenance, and testing of gas equipment in health care facilities.

Chapter 11 Gas Equipment
11.1 Applicability
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Emergency Management.
Chapter 12 establishes criteria for emergency management in the development of a program for effective disaster preparedness, response, mitigation, and recovery in health care facilities. Because no single model of an emergency management plan is feasible for every health care facility, this chapter is intended to provide criteria for the preparation and implementation of an individual plan. The principles involved are universally applicable; the implementation

needs to be tailored to the specific facility.

Chapter 12 Emergency Management
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Security Management. Chapter 13 covers the performance, maintenance, and testing of security equipment and systems in health care facilities.

Chapter 13 Security Management
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13.8 Security Equipment
13.9 Employment Practices
13.10 Security Operations
13.11 Program Evaluation

Hyperbaric Facilities.
Chapter 14 covers the recognition of, and protection against, hazards of an electrical, explosive, or implosive nature, as well as fire hazards associated with hyperbaric chambers and associated facilities that are used, or intended to be used, for medical applications and experimental procedures at gauge pressures from 0 kPa to 690 kPa (0 psi to 100

psi).

During the past 20 years, there has been a widespread interest in the use of oxygen at elevated environmental pressure to increase the partial pressure of oxygen in a patient's tissues in order to treat certain medical conditions or to prepare a patient for surgery. These techniques are also employed widely for the treatment of decompression sickness (e.g., bends, caisson worker's disease) and carbon monoxide poisoning. Recently, however, the level of knowledge and expertise has increased so dramatically that the codes are in need of updating. By the end of 1988, there were 218 hyperbaric facilities in operation in the United

States and Canada. These facilities supported hyperbaric medical treatments for 62,548 patients between 1971 and 1987. As these facilities provide therapy for disorders indicated for treatment, these numbers will continue to increase. As the number of facilities increases, the number of patients treated will also increase. Such treatment involves placement of the patient, with or without attendants, in a hyperbaric chamber or pressure vessel, the pressure of which is raised above ambient pressure. In the course of the treatment, the patient breathes up to 100 percent oxygen. In addition to being used for patient care, these chambers also are being employed for research purposes using

experimental animals and, in some instances, humans. The partial pressure of oxygen present in a gaseous mixture is the determinate factor in the amount of available oxygen. This pressure will rise if the volume percentage of oxygen present increases, if the total pressure of a given gas mixture containing oxygen increases, or if both these factors increase. Because the sole purpose of the hyperbaric technique of treatment is to raise the total pressure within the treatment chamber, an increased partial pressure of oxygen always is available during treatment, unless positive means are taken to limit the oxygen content. In addition, the patient is often given an oxygen-enriched atmosphere to breathe. The need for

human diligence in the establishment, operation, and maintenance of hyperbaric facilities is continual. The chief administrator of the facility possessing the hyperbaric chamber is responsible to adopt and enforce appropriate regulations for hyperbaric facilities. In formulating and administering the program, full use should be made of technical personnel highly qualified in hyperbaric chamber operations and safety. It is essential that personnel having responsibility for the hyperbaric facility establish and enforce appropriate programs to fulfill the provisions of Chapter 14. Potential hazards can be controlled only when continually recognized and understood by all pertinent personnel. The

purpose of Chapter 14 is to set forth minimum safeguards for the protection of patients or others subject to, and personnel who administer, hyperbaric therapy and experimental procedures. Its purpose is also to offer some guidance for rescue personnel who are not ordinarily involved in hyperbaric chamber operation, but who could become so involved in an emergency. Discretion on the part of chamber operators and others might dictate the establishment of more stringent regulations.

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Features of Fire Protection.
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Annex D Informational References
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What does NFPA 99 address?

Requirements address

- installation,
- inspection,
- testing,
- maintenance,
- performance, and
- safe practices for facilities,
- material,
- equipment, and
- appliances, including
- medical gas and vacuum systems.

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FDA Webinar on Preventing Surgical Fires
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Fires in Health Care Facilities

Other items you must know before you are a NFPA 99 Specialist

Know your:

Building Construction Type

Type I (fire resistive) Least combustible
Type II (non-combustible)
Type III (ordinary)
Type IV (heavy timber)
Type V (wood frame) Most combustible

Construction Types - Definitions

TYPE I-A--Fire Resistive Non-combustible (Commonly found in high-rise buildings and Group I occupancies).

3 Hr. Exterior Walls* 3 Hr. Structural Frame
2 Hr. Floor/Ceiling Assembly
1 ½ Hr. Roof Protection

TYPE I-B--Fire Resistive Non-Combustible (Commonly found in mid-rise office & Group R buildings).

2 Hr. Exterior Walls* 2 Hr. Structural Frame 2 Hr. Ceiling/Floor Separation 1 Hr. Ceiling/Roof Assembly

TYPE II-A--Protected Non-Combustible (Commonly found in newer school buildings).

1 Hr. Exterior Walls 1 Hr. Structural Frame 1 Hr. Floor/Ceiling/Roof Protection

TYPE II-B--Unprotected Non-Combustible (Most common type of non-combustible construction used in commercial buildings).

Building constructed of non-combustible materials but these materials have no fire resistance.

TYPE III-A--Protected Combustible (Also known as "ordinary" construction with brick or block walls and a wooden roof or floor assembly which is 1 hour fire protected).

2 Hr. Exterior Walls*
1 Hr. Structural Frame 1 Hr. Floor/Ceiling/Roof Protection

TYPE III-B--Unprotected Combustible (Also known as "ordinary" construction; has brick or block walls with a wooden roof or floor assembly which is not protected against fire. These buildings are frequently found in "warehouse" districts of older cities.)
2 Hr. Exterior Walls* No fire resistance for structural frame, floors, ceilings, or roofs.

TYPE IV--Heavy Timber (also known as "mill" construction; to qualify all wooden members must have a minimum nominal dimension of 8 inches.)
2 Hr. Exterior Walls* 1 Hr. Structural Frame or Heavy Timber Heavy Timber Floor/Ceiling/Roof Assemblies

TYPE V-A--Protected Wood Frame (Commonly used in the construction of newer apartment buildings; there is no exposed wood visible.)
1 Hr. Exterior Walls 1 Hr. Structural Frame 1 Hr. Floor/Ceiling/Roof

TYPE V-B--Unprotected Wood Frame (Examples of Type V-N construction are single family homes and garages. They often have exposed wood so there is no fire resistance.)

2. Occupancy Classification IBC

302.1 General. Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed below. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5
2. Business (see Section 304): Group B
3. Educational (see Section 305): Group E
4. Factory and Industrial (see Section 306): Groups F-1 and F-2
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5

6. Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4
7. Mercantile (see Section 309): Group M
8. Residential (see Section 310): Groups R-1, R-2, R-3 and R-4
9. Storage (see Section 311): Groups S-1 and S-2
10. Utility and Miscellaneous (see Section 312): Group U

OSHPD or Office of Statewide Health Planning and Development

The Organizations that deal with the gases or any type of hazards within City are the building and Fire departments. OSHPD or Office of Statewide Health Planning and Development. OSHPD has multiple levels:

OSHPD Facilities	
OSHPD 1	General acute-care hospitals and skilled nursing and/or intermediate-care facilities
OSHPD 2	Single-story skilled nursing and/or intermediate-care facili utilizing type V wood or light steel-frame construction
OSHPD 3	Licensed clinics
OSHPD 4	Correctional treatment centers

For the discussion for this article, we are only interested on OSHPD 3 facilities. These facilities are now under jurisdiction of local authorities. The most confusing area is that who is in charge? Who controls this facilities design and construction?

The other standards is written by National Fire Protection Association, NFPA99. In this standard which in near future will be considered as code, the gases used in medical industry are subdivided into three categories for 2005 and four in 2012. The categories are based on level of injuries or death that is caused during the operations:

OSHPD Applications

OSHPD 1 *General acute-care hospitals and acute psychiatric hospitals, excluding distinct part units or distinct part freestanding buildings providing skilled nursing or intermediate-care services. For Structural Regulations: Skilled nursing facilities and/or intermediate-care facilities except those skilled nursing facilities and intermediate care facilities of single story, Type V, wood or light steel-frame construction.*

OSHPD 2 *Skilled nursing facilities and intermediate-care facilities, including distinct part skilled nursing and intermediate-care services on a general acute-care or acute psychiatric hospital license, provided either in a*

separate unit or a freestanding building. For Structural Regulations: Single-story, Type V skilled nursing facility and/or intermediate-care facilities utilizing wood or light steel-frame construction.

***OSHPD 3** Licensed clinics and any freestanding building under a hospital license where outpatient clinical services are provided.*

***OSHPD 4** Correctional Treatment Centers.*

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15.14

	NFPA99- 2005
Level 1 /Category 1 in 2012	"System serving patients where an interruption of the piped gas or va system would place patients in imminent danger of morbidity or morta In other words, Facilities where an interruption of the piped systems v place the patients in immediate danger of morbidity or mortality. This usually limited to hospitals where patients are dependent for life on th gases or where mechanical ventilation is utilized at any time.
Level 2 /Category 2 in 2012	"Interruption of system would place patient at manageable risk of mo or mortality." In other words: Facilities where an interruption in the pip systems would place the patients at manageable risk of morbidity or mortality. This is limited to facilities that stand apart from hospitals, ar interconnected to hospital medical gases, and the patients do not req mechanical ventilation or assisted mechanical ventilation, including d anesthesia

Level 3 /Category 3 in 2012	Interruption of system would terminate procedure but would not put p at risk." Facilities where interruptions in the piped systems would terr procedures but would not place the patients at risk of morbidity or mortality. The facility's total quantity of gases, except nitrogen, does exceed 3,000 cubic feet, and only cylinders are used to supply oxyge and nitrous oxide to the facility (exception for cryogenic liquid oxygen This is usually limited to occupancies like dental offices.
Category 4 in 2012	In NFPA 2012 not in 2005

Chapter 4 Fundamentals

4.1* **Building System Categories.** Building systems in health care facilities shall be designed to meet system Category 1 through Category 4 requirements as detailed in this code.

4.1.1* **Category 1.** Facility systems in which failure of such equipment or system is likely to cause major injury or death of patients or caregivers shall be designed to meet system Category 1 requirements as defined in this code.

4.1.2* **Category 2.** Facility systems in which failure of such equipment is likely to cause minor injury to patients or caregivers shall be designed to meet system Category 2 requirements as defined in this code.

4.1.3 **Category 3.** Facility systems in which failure of such equipment is not likely to cause injury to patients or

caregivers, but can cause patient discomfort, shall be designed to meet system Category 3 requirements as defined in this code.

4.1.4 **Category 4.** Facility systems in which failure of such equipment would have no impact on patient care shall be designed to meet system Category 4 requirements as defined in this code.

4.2* **Risk Assessment.** Categories shall be determined by following and documenting a defined risk assessment procedure.

4.3 **Application.** The Category definitions in Chapter 4 shall apply to Chapters 5 through 11.

1. Major injury or death
2. Minor injury
3. Not likely to cause injury
4. No Impact

Definitions:

1. Standard vs. Code: Legislative Process Changes
2. Levels vs. Categories: Occupancy-Based vs. Risk-Based

Are you an Engineer or a Physician?

Would you like to be part of legal process?

Get Letter from the Doctor

Affix to Sheet Title/cover Sheet

When & why did it change from Levels to Categories?

How is “the facility” for the purposes of the medical gas pipeline equipment required defined?

Who makes the decision as to which Category applies and how?

How do the Architect/Engineer and the Certifiers know what to design and certify to?

Exercise 1*

*: from Mark Allen ASPE Seminar

Designate the appropriate “Category” for these facilities:

- General Hospital
- Plastic Surgery Office
- Doc in a Box

- Dental Practice
- Oral Surgeon
- Sleep Lab
- Dental Office
- Dental Implant
- Procedures??????????????????
- Eye Exam
- Foot Surgery
- OSHPD 1
- OSHPD 2
- OSHPD 3
- OSHPD4
- Optometrist

NFPA 99 and Engineering Concerns

9 11 2013

ASPE OC/LA Joint *Symposi*

Confusion is in the City Halls more than ever for OSHPD 3, Optometrist, Ophthalmology, Dental Offices

Which of the following is performed under “minimal sedation”?

- Open heart Surgery
- Caesarean Section
- Cast for Broken Bones
- Cardiac Catherization
- Colonoscopy
- Normal Childbirth
- Oral Surgery
- Cavity filling
- Root Canal
- Liposuction
- Tatooing
- Tatoo Removal

The "Governing Authority of the Health Care Organization" must designate all areas which are:

- critical care
- general care
- basic care
- support
- anesthetizing locations- Levels?

wet procedure locations

3.3.185* Wet Locations. The area in a patient care area where a procedure is performed that is normally subject to wet conditions, including all operating rooms, while patients are present, including standing fluids on the floor or drenching of the work area, either of

which condition is intimate to the patient or staff.

A.3.3.185 Wet Locations. Routine housekeeping procedures do not define a wet location. Spillage of liquids in an operating room location where surgery is performed is considered a wet location."

A Brief Detour: UFC/CFC

The final main code is Uniform Fire Code:

SECTION 3006
MEDICAL GAS SYSTEMS

3006.1 General. *Compressed gases* at hospitals and similar facilities intended for inhalation or sedation including, but not limited to, **analgesia systems for dentistry, podiatry, veterinary** and similar uses shall comply with Sections 3006.2 through 3006.4 in addition to other requirements of this chapter.

3006.2 Interior supply location. Medical gases shall be stored in areas dedicated to the storage of such gases without other storage or uses. Where containers of medical gases in quantities greater than the permit amount are located inside buildings, they shall be in a 1-hour exterior room, a 1-hour interior room or a gas cabinet in accordance with Section 3006.2.1, 3006.2.2 or 3006.2.3, respectively. Rooms or areas where medical gases are stored or used in quantities exceeding the

***maximum allowable quantity per control area* as set forth in Section 2703.1 shall be in accordance with the *International Building Code* for high-hazard *Group H* occupancies**.

3006.2.1 One-hour exterior rooms. A 1-hour exterior room shall be a room or enclosure separated from the remainder of the building by *fire barriers* with a *fire-resistance rating* of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be self-closing smoke-and draft-control assemblies having a *fire protection rating* of not less than 1 hour. Rooms shall have at least one exterior wall that is provided with at least two vents. Each vent shall not be less than 36 square inches (0.023 m^2) in area. One vent shall be within 6 inches (152 mm) of the floor and one shall be within 6 inches (152 mm) of the ceiling. Rooms shall be provided with at least one automatic sprinkler to provide container cooling in case of fire.

3006.2.2 One-hour interior room. When an exterior wall cannot be provided for the room, automatic sprinklers shall be installed within the room. The room shall be exhausted through a duct to the exterior. **Supply and exhaust ducts shall be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior *(Fire Wrap?!)*.. *Approved* mechanical ventilation shall comply with the *California Mechanical Code* and be provided at a minimum rate of 1 cubic foot per minute per square foot [0.00508 $m^3/(s \cdot m^2)$] of the area of the room. *(Where is the Mechanical Plan Checker?!)***

3006.2.3 Gas cabinets. Gas cabinets shall be constructed in accordance with Section 2703.8.6 and the following:

1. The average velocity of ventilation at the face of 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. They shall be connected to an exhaust system.
3. They shall be internally sprinklered.

3006.3 Exterior supply locations. Oxidizer medical gas systems located on the exterior of a building with quantities greater than the permit amount shall be located in accordance with Section 4004.2.1.

3006.4 Medical gas systems. Medical gas systems including, but not limited to, distribution piping, supply manifolds, connections, pressure regulators and relief devices and valves, shall comply with NFPA 99 and the general provisions of this chapter.

SECTION 3007
COMPRESSED GASES NOT OTHERWISE REGULATED

3007.1 General. *Compressed gases* in storage or use not regulated by the material-specific provisions of Chapters 6, 31, 35 and 37 through 44, including asphyxiant, irritant and radioactive gases, shall comply with this section in addition to other requirements of this chapter.

3007.2 Ventilation. Indoor storage and use areas and storage buildings shall be provided with mechanical exhaust ventilation or natural ventilation in accordance with the requirements of Section 2704.3 or 2705.1.9. When mechanical ventilation is provided, the systems shall be operational during such time as the building or space is occupied.

The issues outstanding are many.

Industrial gas piping regulations, controls, the hazardous quantities are not checked by nearly anyone or sparse check at best.

This section of the code is like an orphan child that no body wants to adopt. However, the imminent danger here is far greater than extreme harsh check for plumbing fixture counts or many archaic planning or building issues.

All organizations must address this carefully and adopt a unified program with multidisciplinary departmental approach.

Some of the plan checks by other Cities are attached and are good start for the greater LA/OC basin.

SECTION 307 HIGH-HAZARD GROUP H

307.1 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 those allowed in *control areas* complying with Section 414, based on the maximum allowable quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *International Fire Code*. Hazardous materials stored, or used on top of roofs or canopies shall be classified as outdoor storage or use and shall comply with the *International Fire Code*. [F]

Exceptions: The following shall not be classified as Group H, but shall be classified as 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 and the *International Fire Code*.
2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the *International Fire Code*.
3. Closed piping system 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 (60°C) 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 in accordance with Section 707 or 1-hour *horizontal assemblies* constructed in accordance with Section 712, or both.
5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
6. Liquor stores and distributors without bulk storage.
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 ventilation is provided in accordance with the *International Mechanical Code*.
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 *International Fire Code*.
12. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per *control area* in Group M or S occupancies complying with Section 414.2.5.
13. The storage of black powder, smokeless propellant and small arms primers in Groups 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 prescribed in the *International Fire Code*.

TABLE 307.1(1) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p] [F]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds	Gas (cubic feet at NTP	Solid pounds (cubic feet	Liquid gallons (pounds)
Combustible liquid[c, i]	II	H-2 or H-3	N/A	120[d, e]	N/A	N/A	120[d]	N/A	N/A	30[d]
	IIIA	H-2 or H-3		330[d, e]			330[d]			80[d]
	IIIB	N/A		13,200[e, f]			13,200[f]			3,300[f]
Combustible fiber	Loose	H-3	(100)	N/A	N/A	(100)	N/A	N/A	(20	N/A
	Baled[o]		(1,000			(1,000)			(20)	
Consumer fireworks (Class C, Common)	1.4G	H-3	125[d, e,	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics, flammable	N/A	H-2	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Cryogenics, inert	N/A	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Cryogenics, oxidizing	N/A	H-3	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Explosives	Division 1.	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.2[g]	(0.25)[g]
	Division 1.	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.2[g]	(0.25)[g]
	Division 1.	H-1 or H-2	5[e, g]	(5)[e, g]	N/A	1[g]	(1)[g]	N/A	1[g]	(1)[g]
	Division 1.	H-3	50[e, g]	(50)[e, g]	N/A	50[g]	(50)[g]	N/A	N/A	N/A

	Division 1.4G	H-3	125[d, e,]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Division 1.[illegible]	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.25	(0.25)[g]
	Division 1.[illegible]	H-1	1[e, g]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flammable Gas	Gaseous	H-2	N/A	N/A	1,000[d,e]	N/A	N/A	1,00[illegible] [d,e]	N/A	N/A
	Liquefied			(150)[d,e]	N/A		(150)[d,e]	N/A		
Flammable liquid[c]	1A	H-2	N/A	30[d, e]	N/A	N/A	30[d]	N/A	N/A	10[d]
	1B and 1C	or H-3		120[d, e]			120[d]			30[d]
Flammable liquid, combination (1A, 1B, 1C)	N/A	H- 2 or H-3	N/A	120[d, e, h]	N/A	N/A	120[d, h]	N/A	N/A	30[d, h]
Flammable solid	N/A	H-3	125[d, [illegible]	N/A	N/A	125[d]	N/A	N/A	25[illegible]	N/A
Inert gas	Gaseous	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
	Liquefied	N/A	N/A	N/A	NL	N/A	N/A	NL	N/A	N/A
Organic peroxide	UD	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.2[illegible] [g]	(0.25)[g]
	I	H-2	5[d, e]	(5)[d, e]	N/A	1[d]	(1)	N/A	1[d]	(1)[d]
	II	H-3	50[d, e]	(50)[d, e]	N/A	50[d]	(50)[d]	N/A	10[illegible]	(10)[d]
	III	H-3	125[d, [illegible]	(125)[d, e]	N/A	125[d]	(125)[d]	N/A	25[illegible]	(25)[d]
	IV	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
	V	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL
Oxidizer	4	H-1	1[e, g]	(1)[e, g]	N/A	0.25[g]	(0.25)[g]	N/A	0.2[illegible] [g]	(0.25)[g]
	3[k]	H-2 or H-3	10[d, e]	(10)[d, e]	N/A	2[d]	(2)[d]	N/A	2[d]	(2)[d]
	2	H-3	250[d, [illegible]	(250)[d, e]	N/A	250[d]	(250)[d]	N/A	50[illegible]	(50)[d]
	1	N/A	4,000[e,	(4,000)[e, f]	N/A	4,000[f]	(4,000)	N/A	1,0[illegible] 0[f]	(1,000)[f]

(continued)

TABLE 307.1(1)-continued MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p] [F]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet	Liquid gallons (pounds)	Gas (cubic feet at NTP	Solid pound (cubic feet)	Liquid gallons (pounds	Gas (cubic feet at NTP	Solid pounds (cubic feet	Liquid gallons (pounds)
Oxidizing gas	Gaseous Liquefied	H-3	N/A N/A	N/A (150)[d,e]	1,500[d,e] N/A	N/A N/A	N/A (150)[d,e]	1500[d,e] N/A	N/A N/A	N/A N/A
Pyrophoric material	N/A	H-2	4[e, g]	(4)[e, g]	50[e, g]	1[g]	(1)[g]	10[g]	0	0
Unstable (reactive)	4	H-1	1[e, g]	(1)[e, g]	10[g]	0.25[g]	(0.25)[g]	2[e, g]	0.25[g]	(0.25)[g]
	3	H-1 or H-2	5[d, e]	(5)[d, e]	50[d, e]	1[d]	(1)[d]	10[d, e]	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	250[d, e]	50[d]	(50)[d]	250[d, e]	10[d]	(10)[d]
	1	N/A	NL	NL	NL	NL	NL	NL	NL	NL
Water reactive	3	H-2	5[d, e]	(5)[d, e]	N/A	5[d]	(5)[d]	N/A	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	N/A	50[d]	(50)[d]	N/A	10[d]	(10)[d]
	1	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; N/A = Not Applicable; UD = Unclassified Detonable

a. For use of *control areas*, see Section 414.2.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. Maximum allowable quantities shall be increased 100 percent when stored in *approved* storage cabinets, day boxes, gas cabinets or exhausted enclosures or in *listed* safety cans in accordance with Section 2703.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be

applied accumulatively.

f. The permitted quantities shall not be limited in a building equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

g. Permitted only in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

h. Containing not more than the maximum allowable quantity per *control area* of Class IA, IB or IC flammable liquids.

i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 603.3.2 of the *International Fire Code*.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment. Storage containers and the manner of storage shall be approved.

l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including

packaging, shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 2703.1.2 of the *International Fire Code*.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

p. The following shall not be included in determining the maximum allowable quantities:

1. Liquid or gaseous fuel in fuel tanks on vehicles.

2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with this code.

3. Gaseous fuels in piping systems and fixed appliances regulated by the *International Fuel Gas Code.*

4. Liquid fuels in piping systems and fixed appliances regulated by the *International Mechanical Code*.

TABLE 307.1(2) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD[a,b,c,i] [F]

MATERIAL	STORAGE[d]			USE-CLOSED SYSTEMS[d]			USE-OPEN SYSTEMS[d]	
	Solid pounds (cubic feet)[e,f]	Liquid gallons (pounds)[e,f]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]
Corrosive	5,000	500	Gaseous 810[f] Liquefied (150)[h]	5,000	500	Gaseous 810[f] Liquefied (150)[h]	1,000	100
Highly toxic	10	(10)[h]	Gaseous 20[g] Liquefied (4)[g,h]	10	(10)	Gaseous 20[g] Liquefied (4)[g,h]	3	(3)[i]
Toxic	500	(500)[h]	Gaseous 810[f] Liquefied (150)[f,h]	500	(500)[i]	Gaseous 810[f] Liquefied (150)[f, h]	125	(125)

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. For use of control areas, see Section 414.2.

b. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics, containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

c. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

d. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

e. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note f also applies, the increase for both notes shall be applied accumulatively.

f. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *International Fire Code.* Where Note e also applies, the increase for both notes shall be applied accumulatively.

g. Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *International Fire Code.*

h. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 2703.1.2 of the *International Fire Code.*

307.1.1 Hazardous materials. Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the *International Fire Code.*
307.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein. **[F]**

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, 2 or 3.

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) (20 kJ/g).

Level 2 aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 aerosol products. Those with a total chemical heat combustion that is greater than 13,000 Btu/lb (30 kJ/g).

AEROSOL CONTAINER. A metal can or a glass or plastic bottle designed to dispense an aerosol. Metal cans shall be limited to a maximum size of 33.8 fluid ounces (1000 ml). Glass or plastic bottles shall be limited to a maximum size of 4 fluid ounces (118 ml).

BALED COTTON. A natural seed fiber wrapped in and secured with industry accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).

BALED COTTON, DENSELY PACKED. Cotton made into banded bales with a packing density of at least 22 pounds per cubic foot (360 kg/m^3), and dimensions complying with the following: a length of 55 inches (1397 ± 20 mm), a width of 21 inches (533.4 ± 20 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).

BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

Artificial barricade. An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

Natural barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

BOILING POINT. The temperature at which the vapor pressure of a liquid equals the atmospheric

pressure of 14.7 pounds per square inch (psi) (101 kPa) gage or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D 86 shall be used as the boiling point of the liquid.

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.

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.

COMBUSTIBLE FIBERS. Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials. This definition does not include densely packed baled cotton.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C).

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

COMPRESSED GAS. A material, or mixture of materials, that:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (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 (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).

2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68°F (20°C).

3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.

4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

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*.

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 CFR, Part 173.137, such a 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.

CRYOGENIC FLUID. A liquid 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 kPa).

DAY BOX. A portable magazine designed to hold explosive materials constructed in accordance with the

requirements for a Type 3 magazine as defined and classified in Chapter 33 of the *International Fire Code*.

DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

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.

EXPLOSION. An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, *deflagration* or *detonation*, decomposition of molecules and runaway polymerization (usually *detonation*s).

2. Physical changes such as pressure tank ruptures.

3. Atomic changes (nuclear fission or fusion).

EXPLOSIVE. A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters and display fireworks, 1.3G (Class B, Special).

The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G (Class C, Common) by the hazardous materials regulations of DOTn 49 CFR, Parts 100-185.

High explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to, black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks, 1.3G (Class B, Special) and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a

considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

UN/DOTn Class 1 explosives. The former classification system used by DOTn included the terms "high" and "low" explosives as defined herein. The following terms further define explosives under the current system applied by DOTn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (i.e., the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not

cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5. Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but that are so insensitive there is very little probability of initiation or of transition from burning to *detonation* under normal conditions of transport.

Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

FIREWORKS. Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, deflagration or *detonation* that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.

Fireworks, 1.3G. (Formerly Class B, Special Fireworks.) Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or *detonation*. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams (617 grains) of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, UN0335 by the DOTn.

Fireworks, 1.4G. (Formerly Class C, Common Fireworks.) Small fireworks devices containing restricted

amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion. Such 1.4G fireworks which comply with the construction, chemical composition and labeling regulations of the DOTn for fireworks, UN0336, and the U.S. Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507, are not explosive materials for the purpose of this code.

FLAMMABLE GAS. A material that is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)] which:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air; or

2. Has a flammable range at 14.7 psia (101 kPa) with air of at least 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E 681.

FLAMMABLE LIQUEFIED GAS. A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

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:

Class IA. Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

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

FLAMMABLE MATERIAL. A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

FLAMMABLE SOLID. A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

HANDLING. The deliberate transport by any means to a point of storage or use.

HAZARDOUS MATERIALS. Those chemicals or substances that are physical hazards or health hazards as defined and classified in this section and the *International Fire Code*, whether the materials are in usable or waste condition.

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 (LD_{50}) 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 (LD_{50}) 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 (LC_{50}) 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.

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 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.

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.

OPERATING BUILDING. A building occupied in conjunction with the manufacture, transportation or use of

explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

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.

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), oxidizer (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).

PYROPHORIC. A chemical with an autoignition temperature in air, at or below a temperature of 130°F (54.4°C).

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.

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

1. A chemical that has a median lethal dose (LD_{50}) 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 (LD_{50}) 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 (LC_{50}) 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.

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.

307.3 High-hazard Group H-1. Buildings and structures containing materials that pose a *detonation* hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following: [F]

Detonable pyrophoric materials

Explosives:

Division 1.1

Division 1.2

Division 1.3

Exception: Materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.

Division 1.4

Exception: Articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms regulations, or unpackaged articles used in process operations that do not propagate a *detonation* or deflagration between articles shall be allowed in H-3 occupancies.

Division 1.5

Division 1.6

Organic peroxides, unclassified detonable

Oxidizers, Class 4

Unstable (reactive) materials, Class 3 detonable and Class 4

307.4 High-hazard Group H-2. Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following: [F]

Class I, II or IIIA flammable or combustible liquids which are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103.4 kPa) gage.

Combustible dusts

Cryogenic fluids, flammable

Flammable gases

Organic peroxides, Class I

Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103 kPa) gage

Pyrophoric liquids, solids and gases, nondetonable

Unstable (reactive) materials, Class 3, nondetonable

Water-reactive materials, Class 3

307.5 High-hazard Group H-3. Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following: [F]

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less

Combustible fibers, other than densely packed baled cotton

Consumer fireworks, 1.4G (Class C, Common)

Cryogenic fluids, oxidizing

Flammable solids

Organic peroxides, Class II and III

Oxidizers, Class 2

Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less

Oxidizing gases

Unstable (reactive) materials, Class 2

Water-reactive materials, Class 2

307.6 High-hazard Group H-4. Buildings and structures which contain materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following: [F]

Corrosives

Highly toxic materials

Toxic materials

307.7 High-hazard Group H-5 structures. Semiconductor fabrication facilities and comparable research and

development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.8. [F]

307.8 Multiple hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified. [F]

Back to NFPA 99

Administration and Definitions:

1.2.1 Construction and equipment requirements shall be **applied only to new construction and new equipment,** except as modified in individual chapters.

1.2.1.1 **Only the altered, renovated, or modernized portion of an existing system or individual component** shall be required to meet the installation and equipment requirements stated in this code.

1.2.1.2 If the alteration, renovation, or modernization **adversely impacts the existing performance requirements** of a system or component, additional upgrading shall be required.

1.2.1.3 An existing system that is not in strict compliance with the provisions of this code shall be permitted to be continued in use, unless the authority having

jurisdiction has determined that such **use constitutes a distinct hazard to life**.

1.2.2 Policies.

1.2.2.1 The health care organization shall ensure that policies are established and maintained that **permit the attending physician to satisfy the emergency needs of any patient that supersede the requirements of this code.**

1.2.2.2 Each such special use shall be clearly documented and reviewed to attempt to have future similar needs met within the requirements of this code.

1.3.4 Patient Care Rooms.

1.3.4.1 The governing body of the facility or its designee shall establish the following areas in accordance with the type of patient care anticipated and with the following definitions of

the classification *(see definition of patient care room in Chapter 3)*:

(1) Critical care rooms
(2) General care rooms
(3) Basic care rooms

1.3.4.2 **Anesthesia.** It shall be the responsibility of the governing body of the health care organization to designate anesthetizing locations.

1.3.4.3 **Wet Procedure Locations.** It shall be the responsibility of the governing body of the health care

organization to designate wet procedure locations.

1.4 **Equivalency.**

1.4.1 Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety to those prescribed by this code. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended

purpose by the authority having jurisdiction.

1.4.2 Alternative systems, methods, or devices approved

2.3.1 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.3.4 Alarm System.

3.3.4.1 ***Area Alarm System.*** A warning system within an area of use that provides continuous visible and audible surveillance of Category 1 and Category 2 medical gas and vacuum systems. (PIP)

3.3.4.2 ***Category 3 Alarm System.*** A warning system within an area of use that provides continuous visible and audible surveillance of Category 3 medical gas systems. (PIP)

3.3.4.3 ***Local Alarm System.*** A warning system that provides continuous visible and audible surveillance of medical gas and vacuum system source equipment at the equipment site. (PIP)

3.3.4.4 ***Master Alarm System.*** A warning system that monitors the operation and condition of the source of supply, the reserve source (if any), and the pressure in the main lines of each medical gas and vacuum piping system. (PIP)

3.3.6 Ambulatory Health Care Center. A building or portion thereof used to provide services or treatment simultaneously to four or more patients that (1) provides, on an outpatient basis, treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; or (2) provides, on an outpatient basis, anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others. (FUN)

3.3.13 Area of Administration. Any point within a room within 4.3m(15 ft) of oxygen equipment or an enclosure containing or intended to contain an oxygen-enriched atmosphere. (MED)

3.3.21 Bulk System. An assembly of equipment, such as storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds, and interconnecting piping, that terminates at the source valve of oxygen or 1452 kg (3200 lb) of nitrous oxide, including unconnected reserves on the site. (PIP)

3.3.21.1 ***Bulk Inert Gas System.*** An assembly of equipment consisting of, but not limited to, storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds, and piping, with a storage capacity of more than 20,000 ft3 (scf) (566 m3) of inert gas including unconnected reserves on hand at the site. The bulk system terminates at the point where the gas supply, at service pressure, first enters the supply line. The containers are either stationary or movable, and the source gas is stored as a compressed gas or cryogenic fluid. (PIP)

3.3.21.2 ***Bulk Nitrous Oxide System.*** An assembly of equipment as described in the definition of *bulk oxygen system* that has a storage capacity of more than 1452 kg (3200 lb) [approximately 793 m3 (28,000 ft3) (at normal temperature and pressure)] of nitrous oxide. (PIP)

3.3.21.3* ***Bulk Oxygen System.*** An assembly of equipment such as oxygen storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds, and interconnecting piping that has a storage capacity of more than 566 m3 (20,000 ft3) of oxygen (at normal temperature and pressure), including unconnected reserves on hand at the site. (PIP)

3.3.22 Category 3 Drive Gas System. An assembly of component parts including, but not limited to, the source, pressure and operating controls, filters and purification equipment, valves, alarm warning systems, alarm wiring, gauges, and a network of piping and suitable outlets that produces and distributes compressed air from cylinders, compressed air from compressors, or nitrogen from cylinders less than 1100 kPa gauge (less than 160 psi gauge) to power devices (hand pieces, syringes, cleaning devices, delivery system chairs, and so forth) as a power source. The system includes the compressor intakes and ends with the service outlet where the user connects their clinical equipment. (PIP)

3.3.23 Category 3 Vacuum System. A Category 3 vacuum distribution system that can be either a wet system designed to remove liquids, air–gas, or solids from the treated area; or a dry system designed to trap liquid and solids before the service inlet and to accommodate air–gas only through the service inlet. (PIP)

(MED)

3.3.29.1 ***Liquid Oxygen Ambulatory Container.*** A container used for liquid oxygen not exceeding 1.5 L (0.396 gal) specifically designed for use as a medical device as defined by

21 USC Chapter 9, the United States Food, Drug and Cosmetic Act, that is intended for portable therapeutic use and to be filled from its companion base unit, which is a liquid oxygen home care container. (MED)

3.3.29.2 ***Liquid Oxygen Base Reservoir Container.*** A container used for liquid oxygen not exceeding 60 L (15.8 gal) specifically designed for use as a medical device as defined by 21 USC Chapter 9, the United States Food, Drug and Cosmetic Act, that is intended to deliver gaseous oxygen for therapeutic use, transfilling, or both. (MED)

3.3.48* Essential Electrical System. A system comprised of alternate sources of power and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. (ELS)

3.3.49 Evacuation — Waste Gas. See 3.3.183, Waste Anesthetic Gas Disposal.

3.3.63.2 ***General Anesthesia.*** A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired. (MED)

3.3.63.3 ***Minimal Sedation (Anxlolysis).*** A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. (MED)

3.3.63.4 ***Moderate Sedation/Analgesia (Conscious Sedation).***
A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patient airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. (MED)

3.3.64 General Care Area. See 3.3.138, Patient Care Room.

3.3.84 Instrument Air. For the purposes of this code, instrument air is air intended for the powering of medical devices unrelated to human respiration (e.g., surgical tools, ceiling arms). Medical air and instrument air are distinct systems for mutually exclusive applications. Instrument air is a medical support gas that falls under the general requirements for medical gases. (PIP)

3.3.87 Invasive Procedure. Any procedure that penetrates the protective surfaces of a patient's body (i.e., skin, mucous membrane, cornea) and that is performed with an aseptic field (procedural site). [Not included in this category are placement of peripheral intravenous needles or catheters used to administer fluids and/or medications, gastrointestinal endoscopies (i.e., sigmoidoscopies), insertion of urethral catheters, and other similar procedures.] (ELS)

3.3.90 Isolation Transformer. A transformer of the multiple winding type, with the primary and secondary windings physically separated, that inductively couples its ungrounded secondary winding to the grounded feeder system that energizes its primary winding. (ELS)

3.3.96* Limited-Combustible (Material). Refers to a building construction material not complying with the definition of *noncombustible material* that, in the form in

which it is used, has a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb), where tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, and includes either of the following: (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 1⁄8 in. (3.2 mm) that has a flame spread index not greater than 50; or (2) materials, in the form and thickness used, having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion, when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*. [**90A,** 2012] (PIP)

3.3.104* Medical Air. For purposes of this code, medical air is air supplied from cylinders, bulk containers, or medical air compressors or reconstituted from oxygen USP and oil-free, dry nitrogen NF. (PIP)

3.3.105 Medical Air Compressor. A compressor that is designed to exclude oil from the air stream and compression chamber and that does not under normal operating

conditions or any single fault add any toxic or flammable contaminants to the compressed air. (PIP)

3.3.106* Medical/Dental Office. A building or part thereof in which the following occur: (1) examinations and minor treatments/procedures are performed under the continuous supervision of a medical/dental professional; (2) only sedation or local anesthesia is involved and treatment or procedures do not render the patient incapable of self-preservation under emergency conditions; and (3) overnight stays for patients or 24-hour operation are not provided. (FUN)

3.3.107 Medical Gas. A patient medical gas or medical support gas. *(See also 3.3.142, Patient Medical Gas and 3.3.109, Medical Support Gas.)* (PIP)

3.3.108 Medical Gas System. An assembly of equipment and piping for the distribution of nonflammable medical gases such as oxygen, nitrous oxide, compressed air, carbon dioxide, and helium. (PIP)

3.3.109 Medical Support Gas. Nitrogen or instrument air used for any medical support purpose (e.g., to remove excess moisture from instruments before further processing, or to operate medical–surgical tools, air-driven booms, pendants, or similar

applications) and, if appropriate to the procedures, used in laboratories and are not respired as part of any treatment. Medical support gas falls under the general requirements for medical gases. (PIP)

3.3.110 Medical–Surgical Vacuum. A method used to provide a source of drainage, aspiration, and suction in order to remove body fluids from patients. (PIP)

3.3.111 Medical–Surgical Vacuum System. An assembly of central vacuum–producing equipment and a network of piping for patient suction in medical, medical–surgical, and waste anesthetic gas disposal (WAGD) applications. (PIP)

3.3.138* Patient Care Room. Any room of a health care facility wherein patients are intended to be examined or treated. (MED)

3.3.138.1* *Basic Care Room.* Room in which the failure of equipment or a system is not likely to cause injury to the patients or caregivers but can cause patient discomfort (Category 3). (MED)

3.3.138.2* *Critical Care Room.* Room in which failure of equipment or a system is likely to cause major injury or death of patients or caregivers (Category 1). (MED)

3.3.138.3* *General Care Room.* Room in which failure of equipment or a system is likely to cause minor injury to patients or caregivers (Category 2). (MED)

3.3.138.4* ***Support Room.*** Room in which failure of equipment or a system is not likely to have a physical impact on patients or caregivers (Category 4). (MED)

3.3.139 Patient Care Vicinity. A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor. (MED)

3.3.142 Patient Medical Gas. Piped gases such as oxygen, nitrous oxide, helium, carbon dioxide, and medical air that are used in the application of human respiration and the calibration of medical devices used for human respiration. (PIP)

3.3.143 Piped Distribution System. A pipeline network assembly of equipment that starts at and includes the source valve, warning systems (master, area, local alarms), bulk gas system signal actuating switch wiring, interconnecting piping, and all other components up to and including the station outlets/ inlets. (PIP)

3.3.144 Piping. The tubing or conduit of the system. The three general classes of piping are main lines, risers, and branch (lateral) lines. (PIP)

3.3.144.1 ***Branch (Lateral) Lines.*** Those sections or portions of the piping system that serve a room or group of rooms on the same story of the facility. (PIP)

3.3.144.2 ***Main Lines.*** The piping that connects the source (pumps, receivers, etc.) to the risers or branches, or both. (PIP)
3.3.144.3 ***Risers.*** The vertical pipes connecting the system main line(s) with the branch lines on the various levels of the facility. (PIP)
3.3.145 Plug (Attachment Plug, Cap). A device that, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle. (MED)
3.3.149 Procedure Room. Where the procedura list is using instrumentation that requires constant observation and control. (MED)
3.3.160 Scavenging. Evacuation of exhaled mixtures of oxygen and nitrous oxide. (PIP)
3.3.161 SCFM. Abbreviation of flow rate units of standard cubic feet per minute. (PIP)
3.3.181 Vaporizer. A heat exchange unit designed to convert cryogenic liquid into the gaseous state. (PIP)
3.3.182* WAGD Interface. A device provided on the anesthesia gas machine that connects the WAGD network to the patient breathing circuit. (PIP)

3.3.183 Waste Anesthetic Gas Disposal (WAGD). The process of capturing and carrying away gases vented from the patient breathing circuit during the normal operation of gas anesthesia or analgesia equipment. (PIP)

3.3.184* Wet Procedure Locations. The area in a patient care room where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. (FUN)

3.4 BICSI Definitions. These terms are defined in *The BICSI Information Transport Systems (ITS) Dictionary*. (HES)

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What are the differences between the 2005 and 2012 NFPA 99- Chapter 5?

- 5.1, 5.2 and 5.3 Change of terms (as a result of the Chapter 4 Fundamentals changes) are now all changed throughout from Levels to Categories
- 5.1.1.5 Subsection 5.1.2 through 5.1.12.3.14.5 and 5.1.14.4.2 shall apply to new health care facilities or facilities making changes that alter the piping.
- 5.1.1.6 Paragraph 5.1.14.4.3 through 5.1.14.4.9 and 5.1.13 through 5.1.15 shall apply to existing health care facilities.
- 5.1.1.7 Paragraph 5.1.14.3 and 5.1.14.4.1 shall apply to new and existing health care facilities.
- 5.1.3.3.1.8 Central supply systems for nitrous oxide and carbon dioxide using cylinders or portable containers shall be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer, but shall never be lower than -29° C (-20°F) or greater than 51.6°C (125°F).(Was +20°F)
- This will greatly increase the number of cylinders required to achieve a given flow requirement as the withdrawal rate of gas from the cylinders decreases as the ambient temperature decreases.

- This will also decrease the cylinder pressure. The manifold must be able to function properly at the lower cylinder pressure.
- 5.1.3.3.1.13 Central supply systems for bulk inert gases systems with a total capacity connected and in storage of 20,000 ft^3 or more of compressed gas or cryogenic fluid at standard temperature and pressure, shall comply with CGA P-18, *Standard for Bulk Insert Gas Systems at Consumer Sites*.
- It was felt this clarification was needed to clearly defined when a system is to be treated as a bulk system.
- 5.1.3.3.2 Design and Construction. Locations for central supply systems and the storage of positive- pressure gases shall meet the following requirements:
- 5.1.3.3.2 (3) If outdoors, they shall be provided with an enclosure (wall or fencing) constructed of noncombustible material with a minimum of two entry/exits. (New)
- 5.1.3.3.2 (5) They shall be compliant with NFPA 70, *National Electric Code* for ordinary locations
- 5.1.3.3.2 (10) They shall protect electrical devices from physical damage (no longer 5 feet AFF)
- 5.1.3.4 **Control equipment**. (New) Controls for central supply systems shall be

permitted to be installed remotely as long as it is in a secure location, the enclosure provides enough space to perform maintenance and repair and for all sources except medical air does not communicate with combustible or flammable materials.

- I.E. – this allows the supply line from the bulk oxygen to be operated at a higher pressure (125 psig) and branched to the hyperbaric area where it is then regulated to operating pressure (80 psig) and then goes on to the facility where it again is regulated (55 psig)
-
- 5.1.3.5.12 Bulk Cryogenic Liquid Systems…shall be in accordance with NFPA 55 (New)
-
- 5.1.3.5.12.2 (6) Have a minimum clearance of 3 ft around the storage container, vaporizer(s), and pressure regulating manifold for system maintenance and operation. (New)
-
- 5.1.3.5.13.2 (7) A minimum of 3 ft of clearance around the EOSC for connection of temporary auxiliary source. (New)

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- 5.1.3.5 **Central Supply Systems**. Central supply systems shall be permitted to consist of the following:
- **5.1.3.5 (8) Proportioning systems for medical air USP** per 5.1.3.6.3.4 (new)
- 5.1.3.5.2 **Permitted Locations for Medical Gases.** This paragraph has been re-written to require that patient medical gases may only be piped into areas where their use would be under the supervision of licensed clinicians for patient treatment:
- 5.1.3.5.4 (1) **Materials.** In those portions of systems intended to handle oxygen at gauge pressures greater than 2413 kPa (350 psi), interconnecting hose shall contain no polymeric materials. Was 300 psi – technically this prohibited the use of portable bulk vessels with 350 psig relief valves
- 5.1.3.5.10 (1) If located outdoors, be installed in an enclosure used only for this purpose and sited to comply with minimum distance requirements in NFPA 55.
  Was per NFPA 5.1.3.4.10.1
- 5.1.3.5.11 (1) If located outdoors, be installed in an enclosure used only for this purpose and sited to comply with minimum distance requirements in NFPA 55.
  Was per NFPA 5.1.3.4.10.1
- 5.1.3.4.12.10 A variant on the cryogenic liquid container manifold shall be permitted having three headers of cylinders. Deleted

- 5.1.3.5.12 Bulk Cryogenic Liquid Systems…shall be in accordance with NFPA 55 (New)
- 5.1.3.5.12.2 (6) Have a minimum clearance of 3 ft around the storage container, vaporizer(s), and pressure regulating manifold for system maintenance and operation. (New)
- 5.1.3.5.13.2 (7) A minimum of 3 ft of clearance around the EOSC for connection of temporary auxiliary source. (New)
- **5.1.3.6.3.4 (c) Liquid ring compressors shall comply with the following:**
-
- (2) Reserve medical air standby headers or a backup compressor shall be installed. (New)
- **5.1.3.6.3.14 Medical Air Quality Monitoring**
-
- (1) Dew point shall be monitored and shall activate a local alarm and all master alarms when the dew point at system delivery pressure exceeds + 2 degrees C (+35 degreed F). Was +4 C / +39 F

- **5.1.3.6.3.15 Category 1 Medical Air Proportioning System (New)**
-
- **5.1.3.6.3.4 (c) Liquid ring compressors shall comply with the following:**

  (2) Reserve medical air standby headers or a backup compressor shall be installed. (New)
- 5.1.3.6.3.12 Compressor Intake

  (A) The medical air compressors shall draw their air from a source of clean air.

  (B) The medical air intake shall be located a minimum of 25 ft from ventilating system exhausts, fuel storage vents, combustion vents, plumbing vents, vacuum & WAGD discharges, or areas that can collect vehicular exhausts or other noxious fumes.

  (c) The medical air intake shall be located a minimum of 20 ft above ground level.

(d) The medical air intake shall be located a minimum of 10 ft from any door, window, or other opening in the building. (New)

- **5.1.3.5.14.4 (4) Liquid hydrocarbons shall be monitored on a continuous basis by pigment indicator or other type of instrument permanently installed downstream of each compressor and shall be inspected & documented daily. DELETED – consensus was this was a meaningless test**
- **5.1.3.6.3.14 Medical Air Quality Monitoring**

(1) Dew point shall be monitored and shall activate a local alarm and all master alarms when the dew point at system delivery pressure exceeds + 2 degrees C (+35 degreed F). Was +4 C / +39 F

- **5.1.3.6.3.15 Category 1 Medical Air Proportioning System (New)**

- 5.1.4.8 Zone Valve – Mostly re-written in attempt to define acceptable location. Zone valves may not be in the same room as the outlet/inlet they control.
- 5.1.6 Manufactured Assemblies – Requirement to be DISS has been dropped.Still required to be gas specific / non-interchangeable. This is to help resolve flow problems.

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- 5.1.9 Category 1 Warning Systems – Most references to "wired" have been changed to "communicate" (to allow advancements in technology – i.e. ethernet, fiber optics, wireless)

- 5.1.9.1 (11) – Methods for protecting the wiring for alarms are listed and clarified.
- 5.1.9.2.3 - Wiring for master alarms has been detailed.
- 5.1.9.2.3.3 clarifies that the wire does not need to be a continuous single strand (splicing at junction boxes is acceptable). 5.1.9.2.3.2 has been added to prohibit "common" conductors (safety improvement)

- 5.1.9.2.3.6 – (New) – The standard now permits a single pair of wires per signal when run underground to a junction box where it first enters the building. From that junction on it must be redundant (same as for all other alarm signal wiring.

- 5.1.10.11.10.1 – The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in performing such installations, including all personnel who actually install the piping system.

- The stipulation that this include *all personnel* who actually install the piping system has been added.
- 5.1.12.2.3.4 – The initial pressure test for vacuum systems has been changed from 60 psig to 150 psig (the same as for pressure gases)
- 5.1.12.2.3.5 & 5.1.12.3.9.2 – Leak test solutions used may not contain ammonia (it will make brass crack)
- 5.1.12.2.6.7 and 7.6 (New) The AHJ or its designee must now witness the 24 hour standing pressure test. A form indicating that this test has been performed & witnessed shall be provided to the verifier at the start of the 5.1.12.3 System Verification testing.
- 5.1.12.3.14.3 (E), (F) & G – The testing of the medical air compressor systems has been clarified. Now to be performed after 12 elapsed hours @ 25% duty cycle. (so the pumps could have as little as 3 hours on them)
- 5.1.13.2 (New) & 5.1.13.1.4
- These paragraphs deal with maintenance, periodic testing and qualifications or

maintenance personnel. Both a facility designed qualification process or through ASSE 6040 are acceptable.

- 5.1.13.2.3 provides a basic list of a maintenance program – manufacturer's preventative maintenance requirements would be layered on top of the basic list.
- 5.1.13.2.3.2 regarding equipment with internal flexible hoses establishes a minimum 18 month interval.
- 5.1.13.2.3.2 (New) Booms & articulating assemblies, other than headwalls, utilizing flexible connectors shall be inspected for leaks at a minimum of once every 12 months.
- 5.1.9.1 (15) (New) Alarm switches/sensors shall be installed so as to be removable.

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Wouldn't it make more sensor to install them in the zone valve box ?

5.1.9.3.5 (New) Area alarm panels for medical gas systems shall provide visual & audible indication in the event a mismatch occurs between transducer(s) and its associated circuit board(s).

5.1.4.11 (New) New or replacement in-line check valves shall be as follows: (1) brass or bronze construction (2) have brazed extensions (3) permit inline serviceability (4) shall not have threaded connections (5) have threaded purge points of 1/8 NPT

5.2.- Overall Category two has been rewritten to mirror Category 1. Also, Medical gas/vacuum systems maintenance & record keeping – was under NFPA chapter 9 – now has been brought under chapter 5

5.3 – Level 3 systems has been completely re-written
- some of the noteworthy changes are: verification is required by a 6030, ventilation requirements same as for Level 1 & 2, requirements for: shut-off valves, labeling of the medical gas supply system, cylinder storage & handling, pipe support, underground piping, verification tests.

5.1.3.4.12.10 A variant on the cryogenic liquid container manifold shall be permitted having three headers of cylinders. Deleted

5.1.4.8 Zone Valve – Mostly re-written in attempt to define acceptable location. Zone valves may not be in the same room as the outlet/inlet they control.

Easy Questions:

Please ……