How NFPA 99 2012 Will Affect Your Medical Gas Systems

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President / Founder
Purely Med Gas, Inc.

March 9, 2017
Webinar
Our Presenter

- Owner & founder of Purely Med Gas, Inc.
- Actively involved in the Medical Gas and Vacuum field for 35 yrs
- Instructor NFPA 99 & ASSE 6000 credentialing courses since 1994
- Credentialed ASSE 6010 Installer, ASSE 6020 Inspector, ASSE 6030 Verifier, ASSE 6040 Service Tech, ASSE 6050 Instructor
- Licensed Master Plumber
- Member of WHEA Code Committee
- Member of ASSE 6000 & CGA M-1 Technical Committees
- Member of ASHE, NFPA, ASSE, ASPE, WHEA, UA and MGPHO
- Consultant to facilities, engineers, architectural firms, regulatory agencies and contractors
NFPA 99 Health Care Facilities Code

- National Fire Protection Association
- Handbook, *No more NFPA 99C*
NFPA 55 & NFPA 45

**NFPA 55**
Compressed Gases and Cryogenic Fluids Code

**NFPA 45**
Standard on Fire Protections for Laboratories Using Chemicals
Key Difference

- 1999: Standard
- 2012: CODE
Key Difference

- 1999: Occupancy Based
- 2012: Risk Based
Contents

Chap 1: Administration
Chap 2: Referenced Publications
Chap 3: Definitions
Chap 4: Fundamentals
Chap 5: Gas & Vacuum Systems
Chap 6: Electrical Systems
Chap 7: Information Technology and Communications Systems for HC Facilities
Chap 8: Plumbing
Chap 9: HVAC
Chap 10: Electrical Equipment
Chap 11: Gas Equipment
Chap 12: Emergency Management
Chap 13: Security Management
Chap 14: Hyperbaric Facilities
Chap 15: Features of Fire Protection
4.1 Building System Categories

- **4.1.1 Category 1** - Facility systems in which failure of such equipment or system is likely to cause major injury or death to patients or caregivers...

- **4.1.2 Category 2** - Facility systems in which failure of such equipment is likely to cause minor injury to patients or caregivers...

- **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...

- **4.1.4 Category 4** - Facility systems in which failure of such equipment would have no impact on patient care...
Key Difference

direction of licensed medical professionals

5.1.3.5.2 Permitted Locations for Medical Gases

1) Direct respiration by patients

2) Clinical application of the gas to a patient, such as the use of an insufflator...

3) Medical device applications directly related to respiration

4) Power for medical devices used directly on patients

5) Calibration of medical devices intended for (1) through (4) patients
Key Difference

Medical Vacuum System Use:

- 5.1.14.1.14 The medical-surgical vacuum and WAGD systems shall not be used for nonmedical applications.

- A.5.1.14.1.4 Other examples of prohibited use of medical-surgical vacuum would be scope cleaning, decontamination, and laser plume.
Key Difference

- 5.1.3.75.1 (3) Analysis, research or teaching lab can be piped directly to the receiver tank via a fluid trap
## Key Differences

### Gas Purity & Particulate Requirements

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2012</th>
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<tbody>
<tr>
<td>Medical Air Dew Point High Alarm</td>
<td>39°F</td>
<td>35°F</td>
</tr>
<tr>
<td>Allowable Particulate Matter</td>
<td>0.1 mg</td>
<td>1 mg</td>
</tr>
<tr>
<td>Allowable Halogenated Hydrocarbons</td>
<td>1 ppm</td>
<td>5 ppm</td>
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</tbody>
</table>
Key Difference

Outdoor Central Supply Systems or Storage

- 1999: One exit
- 2012: Two exits
Key Differences

- 3’-0” Clearance around all Bulk Cryogenic Liquid systems and in front of EOSC
- 10’-0” Parking from Bulk
Key Differences

- NO Combustibles in Manifold / Cylinder Storage Rooms (includes wooden racks, etc.)
Key Difference

Cylinder Supports:

1999: “Cylinders in service and in storage shall be individually secured and located to prevent falling or being knocked over.”

2012: “They shall be provided with racks, chains, or other fastenings to secure all cylinders from falling, whether connected, unconnected, full, or empty.”
Key Difference

“WAGD” - “Evacuation” - “Scavenger”

WAGD Inlet required where Nitrous Oxide or Halogenated Anesthetic Gas is administered

Dedicated WAGD producer:
- Oil-less or Inert Oil

Combined WAGD/Vacuum producer:
- Oxidizers below 23.6%
- Or Oil-less or Inert Oil
- 5 ft of Vacuum pipe before WAGD connection
Key Difference

- 5.1.4.8.7 Individual Zone Valves are not required for each minimal sedation location
Key Difference

- 5.1.9.3 (1) An Area Alarm is not required for minimal sedation areas
Key Difference

Non-Stationary Booms Flexible Connectors:

- 5.1.14.2.3.2 Nonstationary booms and articulating assemblies, other than head walls utilizing flexible connectors, shall be tested for leaks, per manufacturer’s recommendations, every 18 mos or at a duration determined by a Risk Assessment.
Computer as Master Alarm

- Continuous uninterrupted power
- Attended or remote signaling
- Supervised signal interface devices
- Signaling devices Life safety branch *
- Wiring supervised or protected
- Audio alert required
- Med gas signal interrupts lesser priority signal
- Wireless

TERMINOLOGY
Pipe Labeling

- Every 20 feet
- Once in each room minimum
- Each side of every wall penetration
- Each floor level
Valve Identification

- Name of Gas or Vacuum system
- Room or Areas served
- A caution to not close or open the valve except in an emergency.
- Ensure these are kept current / accurate following modifications
Alternative Pipe Joints

- **Welded Joints** (5.1.10.5)
- **Memory metal fittings** (5.1.10.6)
- **Dielectric fittings** (5.1.10.9.2)
- **Axially swaged elastic strain preload fittings** (5.1.10.7)
“Flameless” Axially Swaged Fitting
“Flameless” Axially Swaged Fitting

Valve Assembly

Area Alarm Transducers
Key Differences

Piping Distribution

- 3-piece check valves with copper extensions, no threads
- Dielectric unions acceptable
- No Soldered Joints for Vacuum Systems
- Deburring & Dimpling
- Not Allowed: Galvanized Steel Piping for Vacuum
- Allowed: Stainless Steel piping for Vacuum
Piping Distribution

5.1.12.2.6.7 The 24-hour standing pressure test of the positive pressure system shall be witnessed by the authority having jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in 5.1.12.3.

5.1.12.2.7.6 same as above for Vacuum
### Key Difference

- **Medical Gas Personnel Credentials**

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<tr>
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<th>1999</th>
<th>2002</th>
<th>2012</th>
<th>2015</th>
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<tbody>
<tr>
<td><strong>ASSE 6010 Installer</strong></td>
<td>-</td>
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<td><strong>ASSE 6030 Verifier</strong></td>
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Regulatory Preparedness
Federal Policy

*Timeline Review: of 2012 LSC*

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<tr>
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<tbody>
<tr>
<td>Proposed</td>
<td>April 2014</td>
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<tr>
<td>Final Rule</td>
<td>May 2016</td>
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<tr>
<td>Effective</td>
<td>July 2016</td>
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<td>Enforcement</td>
<td>Nov 2016</td>
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# Updated Standards

<table>
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<tr>
<th>NFPA</th>
<th>Standard</th>
<th>Year</th>
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<tr>
<td>13</td>
<td>Sprinkler Systems</td>
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<td>45</td>
<td>Laboratories</td>
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<td>55</td>
<td>Compressed Gases &amp; Cryo</td>
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<td>Ventilation</td>
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<td>96</td>
<td>Cooking</td>
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<td>Healthcare</td>
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<td>K Tag</td>
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<td>K323</td>
<td>Anesthetizing Locations</td>
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<td>K900</td>
<td>Healthcare Facilities Code</td>
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<tr>
<td>K901</td>
<td>Fundamentals - Building System Categorization</td>
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<td>K902</td>
<td>Gas and Vacuum Piped Systems - Other</td>
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<td>K903</td>
<td>Gas and Piped System (G&amp;PS) Categories</td>
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<td>K904</td>
<td>G&amp;VS Warning Systems</td>
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<td>K905</td>
<td>G&amp;VS Identification &amp; Labeling</td>
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<td>K906</td>
<td>G&amp;VS Central Supply System Operation</td>
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<td>K907</td>
<td>G&amp;VS Maintenance Program</td>
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<td>K908</td>
<td>G&amp;VS Inspection &amp; Testing</td>
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<td>K909</td>
<td>G&amp;VS Info &amp; Warning Signs</td>
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<tr>
<td>K910</td>
<td>G&amp;VS Modifications</td>
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K Tags

K922  Gas Equipment (GE) - Other
K923  GE Cylinder & Container Storage
K924  GE Testing & Maintenance
K925  GE Respiratory Therapy Source of Ignition
K926  GE Qualification & Training of Personnel
K927  GE Transfilling Cylinders
K928  GE Labeling Equipment & Cylinders
K929  GE Handling Oxygen Cylinders & Manifolds
K930  GE Liquid Oxygen Equipment
K931  Hyperbaric Facilities
Fundamentals – Building System Categories
Building systems are designed to meet Category 1 through 4 requirements as detailed in NFPA 99. Categories are determined by a formal and documented risk assessment procedure performed by qualified personnel. Chapter 4 (NFPA 99)
K902

Gas and Vacuum Piped Systems – Other
List in the REMARKS section any NFPA 99 Chapter 5 Gas and Vacuum Systems requirements that are not addressed by the provided K-Tags, but are deficient. This information, along with the applicable Life Safety Code or NFPA standard citation, should be included on Form CMS-2567. Chapter 5 (NFPA 99)
Gas and Vacuum Piped Systems – Central Supply System Identification and Labeling

Containers, cylinders and tanks are designed, fabricated, tested, and marked in accordance with 5.1.3.1.1 through 5.1.3.1.7. Locations containing only oxygen or medical air have doors labeled with "Medical Gases, NO Smoking or Open Flame". Locations containing other gases have doors labeled "Positive Pressure Gases, NO Smoking or Open Flame, Room May Have Insufficient Oxygen, Open Door and Allow Room to Ventilate Before Opening.” 5.1.3.1, 5.2.3.1, 5.3.10 (NFPA 99)
Gas and Vacuum Piped Systems – Maintenance Program

Medical gas, vacuum, WAGD, or support gas systems have documented maintenance programs. The program includes an inventory of all source systems, control valves, alarms, manufactured assemblies, and outlets. Inspection and maintenance schedules are established through risk assessment considering manufacturer recommendations. Inspection procedures and testing methods are established through risk assessment. Persons maintaining systems are qualified as demonstrated by training and certification or credentialing to the requirements of AASE 6030 or 6040, 5.1.14.2.1, 5.1.14.2.2, 5.1.15, 5.2.14, 5.3.13.4.2 (NFPA 99)
Gas and Vacuum Piped Systems – Inspection and Testing Operations
The gas and vacuum systems are inspected and tested as part of a maintenance program and include the required elements. Records of the inspections and testing are maintained as required. 5.1.14.2.3, B.5.2, 5.2.13, 5.3.13, 5.3.13.4 (NFPA 99)
Gas and Vacuum Piped Systems – Information and Warning Signs
Piping is labeled by stencil or adhesive markers identifying the gas or vacuum system, including the name of system or chemical symbol, color code (Table 5.1.11), and operating pressure if other than standard. Labels are at intervals not more than 20 feet, are in every room, at both sides of wall penetrations, and on every story traversed by riser. Piping is not painted. Shutoff valves are identified with the name or chemical symbol of the gas or vacuum system, room or area served, and caution to not use the valve except in emergency. 5.1.14.3, 5.1.11.1, 5.1.11.2, 5.2.11, 5.3.13.3, 5.3.11 (NFPA 99)
Gas and Vacuum Piped Systems – Modifications
Whenever modifications are made that breach the pipeline, any necessary installer and verification test specified in 5.1.2 is conducted on the downstream portion of the medical gas piping system. Permanent records of all tests required by system verification tests are maintained. 5.1.14.4.1, 5.1.14.4.6, 5.2.13, 5.3.13.4.3 (NFPA 99)
Gas Equipment – Cylinder and Container Storage ≥ 3,000 cubic feet

Storage locations are designed, constructed, and ventilated in accordance with 5.1.3.3.2 and 5.1.3.3.3. > 300 but <3,000 cubic feet Storage locations are outdoors in an enclosure or within an enclosed interior space of non- or limited- combustible construction, with door (or gates outdoors) that can be secured. Oxidizing gases are not stored with flammables, and are separated from combustibles by 20 feet (5 feet if sprinklered) or enclosed in a cabinet of noncombustible construction having a minimum 1/2 hr. fire protection rating.
≤ 300 cubic feet In a single smoke compartment, individual cylinders available for immediate use in patient care areas with an aggregate volume of ≤ 300 cubic feet are not required to be stored in an enclosure. Cylinders must be handled with precautions as specified in 11.6.2. A precautionary sign readable from 5 feet is on each door or gate of a cylinder storage room, where the sign includes the wording as a minimum "CAUTION: OXIDIZING GAS(ES) STORED WITHIN NO SMOKING". Storage is planned so cylinders are used in order of which they are received from the supplier. Empty cylinders are segregated from full cylinders. When facility employs cylinders with integral pressure gauge, a threshold pressure considered empty is established. Empty cylinders are marked to avoid confusion. Cylinders stored in the open are protected from weather. 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.6.5 (NFPA 99)
Gas Equipment – Qualifications and Training of Personnel
Personnel concerned with the application, maintenance and handling of medical gases and cylinders are trained on the risk. Facilities provide continuing education, including safety guidelines and usage requirements. Equipment is serviced only by personnel trained in the maintenance and operation of equipment. 11.5.2.1 (NFPA 99)
Gas Equipment – Transfilling Cylinders
Transfilling of oxygen from one cylinder to another is in accordance with CGA P-2.5, Transfilling of High Pressure Gaseous Oxygen Used for Respiration. Transfilling of any gas from one cylinder to another is prohibited in patient care rooms. Transfilling to liquid oxygen containers or to portable containers over 50 psi comply with conditions under 11.5.2.3.1 (NFPA 99). Transfilling to liquid oxygen containers or to portable containers under 50 psi comply with conditions under 11.5.2.3.2 (NFPA 99). 11.5.2.2 (NFPA 99)
Gas Equipment – Labeling Equipment and Cylinders
Equipment listed for use in oxygen-enriched atmospheres are so labeled. Oxygen metering equipment and pressure reducing regulators are labeled "OXYGEN-USE NO OIL". Flowmeters, pressure reducing regulators, and oxygen-dispensing apparatus are clearly and permanently labeled designating the gases for which they are intended. Oxygen-metering equipment, pressure reducing regulators, humidifiers, and nebulizers are labeled with name of manufacturer or supplier. Cylinders and containers are labeled in accordance with CGA C-7. Color coding is not utilized as the primary method of determining cylinder or container contents. All labeling is durable and withstands cleaning or disinfecting. 11.5.3.1 (NFPA 99)
Regulatory Preparedness

- Risk Assessment
- Current Inventory
- Equipment Location Drawings
Regulatory Preparedness

- Testing/Verification Records
- Inspection Records
- Planned Maintenance Records
  - **ALL Categories**
Regulatory Preparedness

- Qualifications
- Cylinder Handling Training
- Emergency Preparedness

Facility Operations and Equipment Service
DTC Facilities Operations

Med Gas Failure (Nitrous Oxide)

Effective Date: 3/4/98
Reviewed/Revised: 11/4/01, 7/9/10, LBE

Responsible: All Facility Operations/Maintenance Personnel

Purpose: To outline the steps to be taken in the event of a failure of all or part of the Med Gas – Nitrous Oxide system.

Policy: It is the policy of Mayo Foundation to take all the necessary steps to ensure the health, safety, and welfare of all patients, visitors, and employees involved in a disruption and/or repair of the Med Gas – Nitrous Oxide system.

Information:
- Possible reasons for Nitrous Oxide system failure:
  1. Equipment malfunction
  2. Depletion of gas
  3. Regulator of gas line
  4. Shutoff of a zone valve

- Warning signs or indications of failure:
  1. Audible alarm
  2. Drop in pressure
  3. Cuff from affected area

- Backup mechanisms and/or resources:
  1. Reserve back-up gas cylinders
  2. Reserve gas tanks on carts available on anesthesia carts

- Areas that may be affected:
  1. Operating rooms

- Additional precautions and procedures:
  1. Verify alarm system
  2. Check gas pressure
  3. Ensure gas tanks are full
  4. Use reserves if necessary

- Emergency contact:
  - Mayo Clinic Fire Department
  - Mayo Clinic Environmental Health
  - Mayo Clinic Risk Management

- Action plan:
  1. Notify qualified personnel
  2. Notify physicians
  3. Notify patients
  4. Evacuate affected areas

- Follow-up:
  1. Evaluate and report
  2. Review and update procedures

Thank You!

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