Healthcare Engineers Society of Northern Illinois

Medical Gas Inspections and Maintenance Programs

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Presented by Mathis Carlson

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I have worked for the last 15+ years in the Medical Gas industry. I maintain my medical gas verifiers, instructors, and maintenance cards, along with additional credentials and plumbing licenses.

I serve on the Board of Directors for the Medical Gas Professional Healthcare Association as the Vice President of Membership.

I currently am employed by Medical Technology Associates as the area supervisor over Illinois, Wisconsin, Indiana and Michigan. I also oversee all of our training programs nationwide.

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Inspections and Maintenance

1. Who is the authority over my hospital?
   - CMS? Who are they?
2. NFPA 99-2012 Healthcare Facilities Code
3. What will my Life Safety Surveyor look for?
4. When should an inspection be performed?
   - What should be included in my inspection program?
5. Medical Gas maintenance Programs
   - Code requirements
   - Qualifications for maintenance personnel

Who governs my hospital?

CMS...Who are they?

- Centers for Medicare and Medicaid Services
  - CMS is a “Federal” program, however it is “State Administered”, so each state sets it’s own guidelines based around the Conditions of Participation (CoP)
  - CMS determines funding reimbursements to healthcare entities providing treatment for Medicare and Medicaid patients
  - CFR Title 42: Public Health
    - Within Title 42 we have Chapter IV: Centers for Medicare & Medicaid Services Department of Health and Human Services

CMS...Who are they?

- 871 pages of regulations
  - Contains NUMEROUS sections such as:
    - Governing Body
    - Nursing Administration
    - Quality Control
    - Laboratory Services
    - PHYSICAL ENVIRONMENT

Code Adoption for Healthcare Organizations

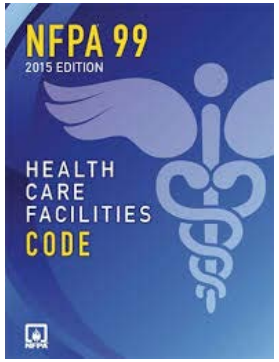
- Effective July 5, 2016 CMS adopted the 2012 edition of the NFPA 99 Healthcare Facilities Code®
- All applicable CMS deemed status accreditation firms such as:
  - Joint Commission, included in January 9, 2017 standards update

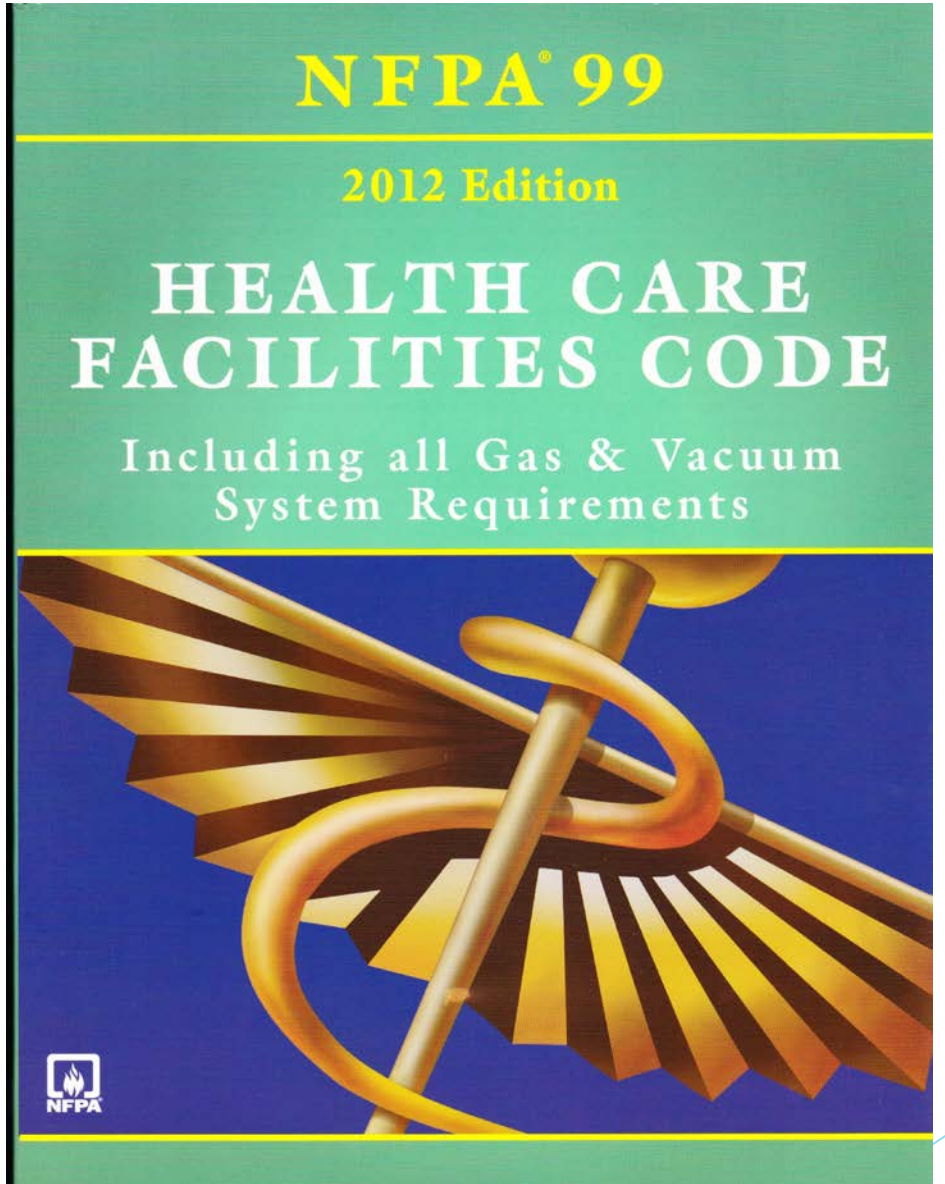
Code Adoption for Healthcare Organizations

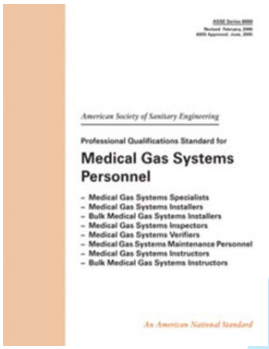
- DNV-GL, included in December 2016 standards update
- AOA/HFAP, included in February 2017 standards update
- CIHQ, included in July 2017 standards update

- We will focus on the NFPA 99-2012 edition to align with CMS standards.

NFPA 99: Healthcare Facilities Code







Applicability

- Applies to all Health Care Facilities, excluding home health and veterinary.(1.3.1)
- Construction and equipment requirements apply to NEW construction and NEW equipment, except as modified in individual chapters. (1.3.2)
- **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. (1.3.2.1)

Applicability

- 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. (1.3.2.3, 5.1.1.4)

NFPA 99

- Chapter 5: Medical Gas and Vacuum Systems
- Chapter 4: Fundamentals
  - NFPA 99 changed from an occupancy based system to a risk based system.
  - 4 categories

NFPA 99

- Chapter 4 Categories
  1. Systems in which failure is likely to cause major injury or death.
  2. Systems in which failure is likely to cause minor injury.
  3. Systems in which failure is likely to patient discomfort.
  4. No impact
- Categories determined by a **FACILITY PERFORMED** risk assessment

So what will our Life Safety Surveyor look for? (LSS)

- In a short amount of time the LSS is trying to check the following items in the healthcare organization:
  - Compliance with all applicable CMS, Accreditation Agency, State and/or local codes and standards.
  - That all buildings and building systems are installed and maintained according to all applicable codes.
  - Patient and employee safety and best practices.

So what will our Life Safety Surveyor look for? (LSS)

- Documentation that defines all of the processes listed above, as well as how they are to be performed.
- Records that show all of the processes were performed according to the established and adopted procedures.
- A document is some type of instruction or mandate as to how the system or process will operate.
- A record is maintained to establish proof of conformity to the document and/or process.

So what will our Life Safety Surveyor look for? (LSS)

Remember:

If you didn't document it, you might as well have not done it. If there is no record of something being done, it is assumed that it was not done.

Documentation

- Your documentation and records should be in a format that insures all of the following:
  1. ANYONE that has to display the information to the LSS can do so easily and efficiently. Remember that it may not be you that will be presenting and explaining the reports to the LSS.
  2. You only want to display the pertinent information.
  3. You want to minimize the time that it takes the LSS to understand your programs and how they are run.

Documentation

4. You want the staff to be able to efficiently review the documents for accuracy.
5. **Confidence leads to success**. The more confident you are in your documentation and processes, the easier this review is.

- The document review is typically the first thing done in a survey. Don't let it set a bad tone for the rest of the process.
- Fill in all the blanks! Blank spaces or fields lead to questions.
- Make sure that inventories are accurate. When adding or removing a device, remember to account for that process.

Documentation

- Have all follow-up documentation (Work orders, re-inspection forms etc.) for any repairs
- Have an accurate index or table of contents. This will help your staff find their way through the documentation easily and be confident in their answers.
- Use clear plain language.
- Make sure that you are using the correct version of the code for your facility/agency. For example, TJC will be on NFPA 99 2012 while a VA hospital will be on NFPA 99 2018.

Documentation

- Separate required deficiencies from suggestions and/or recommendations. Only place a code required item in the deficiencies list. If a newer code has a different requirement, place it in the suggestions list rather than deficiencies.
- If your facility is with DNV-GL the equipment calibration records for all test equipment MUST be included with your documentation. Always a good idea to have this.

Documentation

- Place the deficiencies near the front of the report. Place repair tickets, work orders and/or other supporting documentation for corrections there after.
- Immediately inform any facility staff that need to know about any deficiencies critical to the operation of the facility. DO NOT wait until the LSS finds them in the documentation review of the survey. Play it safe notify via e-mail or in writing so that there is a record.

How often should I be testing and inspecting my medical gas systems?

- The Joint Commission
  - EC.02.05.09 states “In a timeframe defined by the hospital, the hospital inspects, tests, and maintains critical components of the piped medical gas and vacuum systems.”

How often should I be testing and inspecting my medical gas systems?

- DNV-GL
  - PE.8, SR.3 The Utility Management System shall develop maintenance, testing and inspection processes for critical utilities.
  - PE.8, SR.4 The Utility Management System shall contain a process to address medical gas systems and HVAC systems. (example negative pressure isolation rooms)

How often should I be testing and inspecting my medical gas systems?

- NFPA 99 2012 Edition
  - **5.1.14.2.2.2* Inspection Schedules.** Scheduled inspections for equipment and procedures shall be established through the risk assessment of the facility and developed with consideration of the original equipment manufacturer recommendations and other recommendations as required by the authority having jurisdiction.

**indicates additional information in the annex*

How often should I be testing and inspecting my medical gas systems?

- **5.1.14.2.2.3 Inspection Procedures.** The facility shall be permitted to use any inspection procedure(s) or testing methods established through its own risk assessment.

How often should I be testing and inspecting my medical gas systems?

- NFPA 99 2012 Edition
  - **5.1.14.4.4** Central supply systems for non-flammable medical gases shall conform to the following:
    (1) They shall be inspected annually.
    (2) They shall be maintained by a qualified representative of the equipment owner.
    (3) A record of the annual inspection shall be available for review by the authority having jurisdiction.

How often should I be testing and inspecting my medical gas systems?

- **5.1.14.4.5** A periodic testing procedure for nonflammable medical gas and vacuum and related alarm systems shall be implemented.
- **5.1.14.4.6** Whenever modifications are made that breach the pipeline, any necessary installer and verification test specified in 5.1.12 shall be conducted on the downstream portions of the medical gas piping system.

How often should I be testing and inspecting my medical gas systems?

- NFPA 99 2012 Edition
  - **5.1.14.4.8** Audible and visual alarm indicators shall meet the following requirements:
    (1) They shall be periodically tested to determine that they are functioning properly.
    (2) Records of the test shall be maintained until the next test is performed.
  - **5.1.14.4.9** Medical–surgical vacuum station inlet terminal performance, as required in 5.1.12.3.10.4, shall be tested as follows:
    (1) On a regular preventive maintenance schedule as determined by the facility maintenance staff.

How are inspection intervals defined?

- The Joint Commission
  - Every 36 months/every 3 years = 36 months from the date of the last event, ± 45 days
  - Annually/every 12 months/once a year/every year = 1 year from the date of the last event, ± 30 days
  - Every 6 months = 6 months from the date of the last event, ± 20 days
  - Quarterly/every quarter = every 3 months, ± 20 days
  - Monthly/30-day interval/every month = 12 times per year, once per month
  - Every week = once per week

How are inspection intervals defined?

- CMS, DNV-GL, HFAP, and CIHQ
  - Annually: once per year as close as possible to 365 days between actions.
  - Quarterly: once every three months as close as possible to 90 days between actions.
  - Monthly: once a month as close as possible to 30 days between actions.
  - Weekly: once a week close as possible to 7 days between actions.
  - Daily: once a day as close as possible to 24 hours between actions.

What should be included in a Medical Gas Inspection?

- 5.1.14.2.3.1 General. The elements in 5.1.14.2.2.2 through 5.1.15 shall be inspected or tested as part of the maintenance program as follows:
  - (1)*Medical air source:

  (a) Room temperature (b) Shaft seal condition

  (c) Filter condition (d) Presence of hydrocarbons,

  (e) Room ventilation (f) Water quality, if so equipped

  (g) Intake location (h) Carbon monoxide monitor calibration

  (i) Air purity (j) Dew point

What should be included in a Medical Gas Inspection?

- *A.5.1.14.2.3.1(1) Additional inspections for medical air sources include the following:*
  - *(1) Aftercoolers (condition, operation of automatic drains)*
  - *(2) Operating pressures (cut-in, cut-out, and control pressures)*
  - *(3) Electrical operation*
  - *(4) Receiver elements (auto/manual drain, sight glass, pressure gauge)*
  - *(5) Pressure regulators (condition)*
  - *(6) Dryer (operation, outlet dew point, condition, housekeeping)*
  - *(7) Dew point calibration*
  - *(8) Housekeeping around compressors*

What should be included in a Medical Gas Inspection?

- (2)*Medical vacuum source — exhaust location
- (3) WAGD source — exhaust location
- *A.5.1.14.2.3.1(2) Additional inspections for medical vacuum sources and WAGD sources include the following:*
  - *(1) Operating vacuum (cut-in, cut-out, and control pressures)*
  - *(2) Electrical operation*
  - *(3) Receiver elements (manual drain, sight glass, vacuum gauge)*
  - *(4) Housekeeping around pump*

What should be included in a Medical Gas Inspection?

- (4)*Instrument air source — filter condition
  - *A.5.1.14.2.3.1(4) Additional inspections for instrument air sources include the following:*
    - *(1) Aftercoolers (condition, operation of drains)*
    - *(2) Operating pressures (cut in, cut out, and control pressures)*
    - *(3) Electrical operation*
    - *(4) Receiver elements (auto/manual drain, sight glass, pressure gauge)*
    - *(5) Pressure regulators (condition)*
    - *(6) Housekeeping around compressors*

What should be included in a Medical Gas Inspection?

- (5)*Manifold sources (including systems complying with 5.1.3.5.10, 5.1.3.5.11, 5.1.3.5.12, and 5.1.3.5.13), as follows:

  (a) Ventilation

  (b) Enclosure labeling

What should be included in a Medical Gas Inspection?

- *A.5.1.14.2.3.1(5) Additional inspections for manifold sources include the following:*
  - *(1) Cylinder leads (condition)*
  - *(2) Cascade (switching from one header to another)*
  - *(3) Source valve (labeling)*
  - *(4) Relief valves (discharge location and condition)*
  - *(5) Leaks*
  - *(6) Security (door or gate locks and signage)*
  - *(7) Housekeeping around manifolds*

What should be included in a Medical Gas Inspection?

- (6) Bulk cryogenic liquid source inspected in accordance with NFPA 55, Compressed Gases and Cryogenic Fluids Code
- (7) Final line regulation for all positive pressure systems — delivery pressure

What should be included in a Medical Gas Inspection?

- (8)*Valves — labeling
  - *A.5.1.14.2.3.1(8) Additional inspections for zone valves include the following:*
    - *(1) Locations (relationship to terminals controlled)*
    - *(2) Leaks*
    - *(3) Labeling*
    - *(4) Housekeeping around valve*

What should be included in a Medical Gas Inspection?

- (9)*Alarms and warning systems—lamp and audio operation
- *A.5.1.14.2.3.1(9) Additional inspections for alarms include the following:*
  - *(1) Dew point monitor (operation and calibration)*
  - *(2) Carbon monoxide monitor (operation and calibration)*
  - *(3) All local alarms on medical air, vacuum, WAGD, manifolds, medical support gas sources (verify presence of required alarms, perform electrical test, test lag alarm)*
  - *(4) Locations (visible to staff)*
  - *(5) Housekeeping around alarms*

What should be included in a Medical Gas Inspection?

- (10) Alarms and warning systems, as follows:
  - (a) Master alarm signal operation
  - (b) Area alarm signal operation
  - (c) Local alarm signal operation

What should be included in a Medical Gas Inspection?

- (11)*Station outlets/inlets, as follows:
  - (a) Flow
  - (b) Labeling
  - (c) Latching/delatching
  - (d) Leaks
- *A.5.1.14.2.3.1(11) An additional inspection for station outlets/ inlets is a general condition (noninterchangeable indexing).*

What should be included in a Medical Gas Inspection?

- Booms
  - Known in the code as **Manufactured Assemblies Employing Flexible Connection(s) Between the User Terminal and the Piping System.**
  - Nonstationary booms and articulating assemblies, other than head walls utilizing flexible connectors, shall be tested for leaks, per manufacturer's recommendations, every 18 months or at a duration as determined by a risk assessment. (5.1.14.2.3.2(A))

What should be included in a Medical Gas Inspection?

- The system pressure to nonstationary booms and articulating arms shall be maintained at operating pressure until each joint has been examined for leakage by effective means of leak detection that is safe for use with oxygen. (5.1.14.2.3.2(B))
- Safe working condition of the flexible assemblies shall be confirmed. (5.1.14.2.3.2(C))
- D.I.S.S. connectors internal to the boom and assemblies shall be checked for leakage. (5.1.14.2.3.2(D))

What should be included in a Medical Gas Inspection?

- Leaks, if any, shall be repaired (if permitted), or the components replaced (if required), and the equipment retested prior to placing the equipment back into service. (5.1.14.2.3.2(E))
- Additional testing of nonstationary booms or articulating arms shall be performed at intervals defined by documented performance data. (5.1.14.2.3.2(F))

Maintenance Programs

- NFPA 99 2012 edition requires that facilities have a documented maintenance program.
  - **5.1.14.2.1* General.** Health care facilities with installed medical gas, vacuum, WAGD, or medical support gas systems, or combinations thereof, shall develop and document periodic maintenance programs for these systems and their subcomponents as appropriate to the equipment installed.

Maintenance Programs

- NFPA 99 2012 edition requires that facilities have a documented maintenance program.
  - **5.1.14.2.2.4 Maintenance Schedules.** Scheduled maintenance for equipment and procedures shall be established through the risk assessment of the facility and developed with consideration of the original equipment manufacturer recommendations and other recommendations as required by the authority having jurisdiction.

Maintenance Programs

- **5.1.14.4.7** Procedures, as specified, shall be established for the following:

  (1) Maintenance program for the medical air compressor supply system in accordance with the manufacturer's recommendations

  (2) Facility testing and calibration procedure that ensures carbon monoxide monitors are calibrated at least annually or more often if recommended by the manufacturer

Maintenance Programs

(3) Maintenance program for both the medical–surgical vacuum piping system and the secondary equipment attached to medical–surgical vacuum station inlets to ensure the continued good performance of the entire medical–surgical vacuum system

(4) Maintenance program for the WAGD system to ensure performance

- **5.1.15* Category 1 Maintenance.** Facilities shall have a routine maintenance program for their piped medical gas and vacuum systems.

Maintenance Programs

- **5.1.15 is not exactly what I would call specific as far as a maintenance program requirement. So Let's look at the annex for some more "clarification"**
- ***A.5.1.15*** *Medical gas and vacuum systems should be surveyed at least annually for the items that follow and deficient items corrected. Survey of medical air and instrument air sources should include, but not be limited to, the following:*

Maintenance Programs

(1) Dew point monitor (operation and calibration)

(2) Carbon monoxide monitor (medical air only) (operation and calibration)

(3) Aftercoolers (condition, operation of drains)

(4) Operating pressures (cut-in, cut-out, and control pressures)

(5) All local alarms (verify presence of required alarms, perform electrical test, test lag alarm)

Maintenance Programs

(6) Receiver elements (auto drain, manual drain, sight glass, pressure gauge)

(7) Filters (condition)

(8) Pressure regulators (condition, output pressure)

(9) Source valve (labeling)

(10) Intake (location and condition)

(11) Housekeeping around compressors

Maintenance Programs

- *Survey of the medical vacuum and the WAGD source(s) should include, but not be limited to, the following:*

  (1) Operating vacuum (cut-in, cut-out, and control pressures)

  (2) All local alarms (verify presence of required alarms, perform electrical test, test lag alarm)

  (3) Receiver elements (manual drain, sight glass, vacuum gauge)

  (4) Source valve (labeling)

  (5) Exhaust (location and condition)

  (6) Housekeeping around pump

Maintenance Programs

- *Survey of the medical gas manifold source(s) should include, but not be limited to, the following:*
  - *(1) Number of cylinders (damaged connectors)*
  - *(2) Cylinder leads (condition)*
  - *(3) Cascade (switching from one header to another)*
  - *(4) All local alarms (verify presence of required alarms, perform electrical test, test all alarms)*

Maintenance Programs

(5) Source valve (labeling)

(6) Relief valves (discharge location and condition)

(7) Leaks

(8) Security (door or gate locks and signage)

(9) Ventilation (general operation, housekeeping)

(10) Housekeeping around manifolds

Maintenance Programs

- *Survey of medical gas area alarms should include, but not be limited to, the following:*
  - *(1) Locations (visible to staff)*
  - *(2) Signals (audible and visual, use test function)*
  - *(3) Activation at low pressure*
  - *(4) Housekeeping around alarm*
- *Survey of medical gas master alarms should include, but not be limited to, the following:*
  - *(1) Locations (visible to appropriate staff)*
  - *(2) Signals (audible and visual, use test function)*
  - *(3) Activation at low pressure*
  - *(4) Housekeeping around alarm*

Maintenance Programs

- *Survey of medical gas area alarms should include, but not be limited to, the following:*
  - *(1) Locations (visible to staff)*
  - *(2) Signals (audible and visual, use test function)*
  - *(3) Activation at low pressure*
  - *(4) Housekeeping around alarm*

Maintenance Programs

- *Survey of medical gas outlet/inlets should include, but not be limited to, the following:*
  - *(1) Flow and function*
  - *(2) Latching/delatching*
  - *(3) Leaks*
  - *(4) General condition (noninterchangeable indexing)*

The facility should retain a written or an electronic copy of all findings and any corrections performed.

So who can perform maintenance?

- **5.1.14.2.2.5 Qualifications.** Persons maintaining these systems shall be qualified to perform these operations. Appropriate qualification shall be demonstrated by any of the following…

So who can perform maintenance?

- (1) Training and certification through the health care facility by which such persons are employed to work with specific equipment as installed in that facility
- Potential Benefits
  - Shorter training, as there is not a set hour requirement
  - Training on the specific equipment that is inside the building
  - Easier to work around staffing, schedules, rotations
  - Lower cost by not having to pay course instruction costs

So who can perform maintenance?

- Potential Issues
  - If you have one maintenance person covering various buildings, a separate training for each building would be required
  - Opens the training program for review in a survey, was it really sufficient?
  - New equipment, or replaced equipment….new training
  - What will it cost the facility to develop and document the training program
  - Manufactures recommendations would be referenced, and those recommendations may require manufactures training at a high cost

So who can perform maintenance?

- (2) Credentialing to the requirements of ASSE 6040, *Professional Qualification Standard for Medical Gas Maintenance Personnel*
- Potential Benefits
  - Path of least resistance, universal card covers everything and all buildings
  - Nationally recognized credential
  - Won't be questioned or reviewed in a survey

So who can perform maintenance?

- Potential Issues
  - No equipment or facility specific training
  - Depending on the credentialing agency, either a 24 or 32 hour course plus an exam
  - Difficult especially for small facilities to pull staff off of work assignments for a week
  - Tuition and testing costs as well as potential travel costs

So who can perform maintenance?

- (3) Credentialing to the requirements of ASSE 6030, *Professional Qualification Standard for Medical Gas Systems Verifiers*


Q&A ?