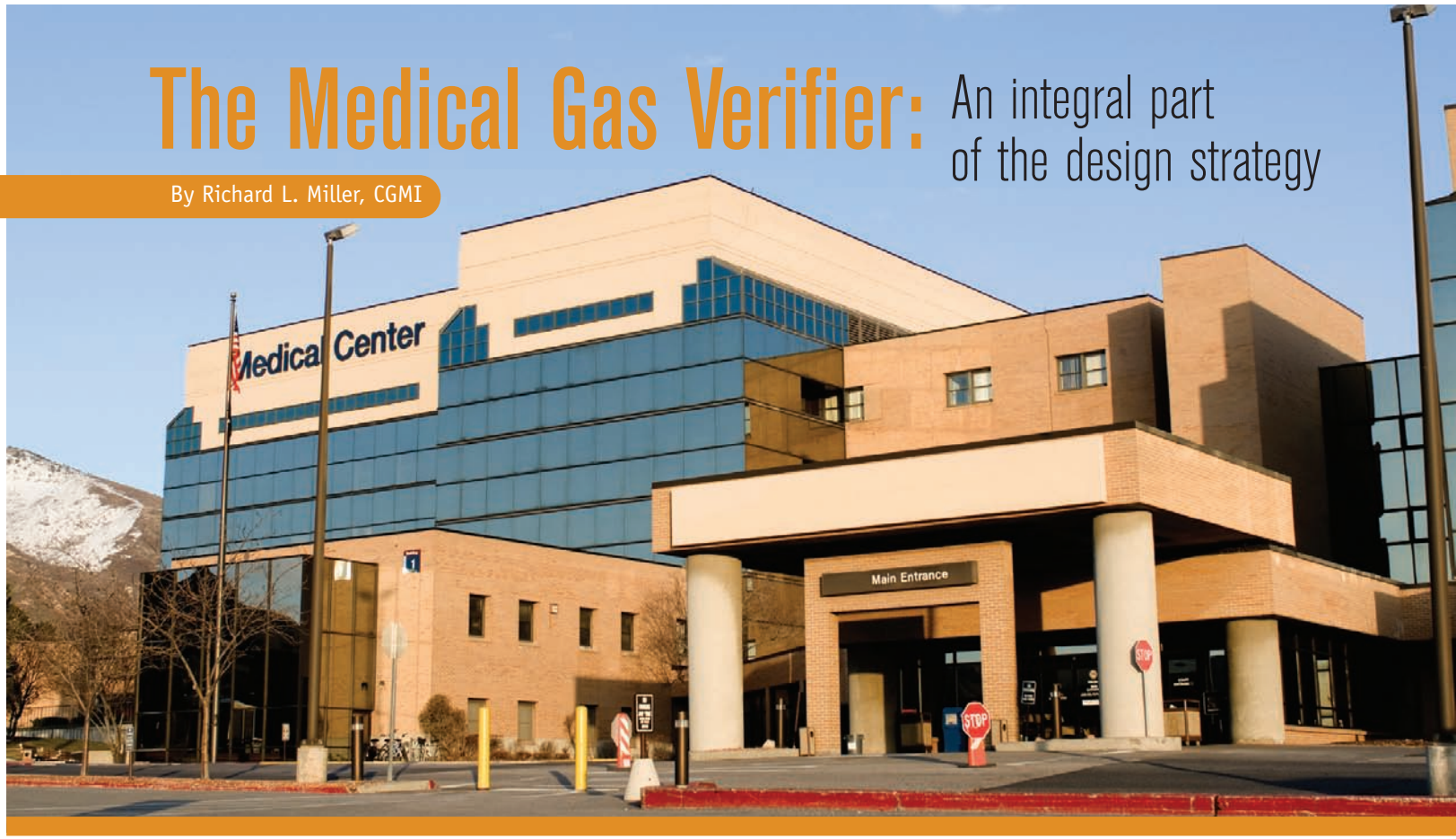
The Medical Gas Verifier: An integral part of the design strategy

By Richard L. Miller, CGMI



I am fortunate to have been involved in the healthcare industry for 30 years; during this time I have worked in hundreds of healthcare facilities on thousands of medical gas system projects. I am extremely proud of the trajectory our industry is taking.

Before the bid

Considering the title of this article, I must ask what role the medical gas verifier played on your last healthcare facility project. Did you involve the verifier from document review through inspection and completion, or did you just require the installing contractor to hire a verifier for final testing?

Medical gas projects start with the design team consulting with the owner to define their specific needs. Plans are drawn and sent through an approval process and, if the project is funded in part by state or federal monies, the state inspectors will be involved. These inspectors are known as the authority having jurisdiction (AHJ). At this point everyone "assumes" the plans are complete and accurate.

The next phase is accepting bids and approving the contractors that will build the project. These contractors typically bid only on what is on the plans so, if the plans are lacking, what happens to the completed work? An important adjunct to the plans is the bid specification, a document in which the design team offers specific guidance. One of the statements commonly found in specifications that I find most interesting is this: "Work shall meet all applicable codes and standards." This seems to a catch-all for designers who are afraid they left something out. When it comes to medical gas system specifications, you also typically find this statement: "All work shall be performed by contractors who are competent, qualified and experienced in making such installations." Good luck trying to quantify competent, qualified, and experienced.

Over the years, I have met most project designers at the end of a project, after I found something wrong. This is not the best time to start a relationship. Forgetting one area alarm at the start of a project can cost as little as $2,500 to rectify. If the same problem is found at the end of a project, and you have to open the casework, the cost can easily exceed $20,000. With today's pace of construction, owners do not easily tolerate these costly changes. However, if the medical gas verifier truly has an integral relationship with the design team, many mistakes can be caught prior to the job being released.

Codes and standards

Minimum design requirements for medical gas systems are found in NFPA 99: Health Care Facilities Code. (The 2012 version has been upgraded from a standard to a code for clarification and easier enforcement.) In the early 2000s, a document was developed by the American Society for Sanitary Engineering to define the professional qualifications of all the interests involved in a medical gas project. The ASSE 6000 series document is broken into several subcategories to define the roles in a project:

- ASSE 6005 Medical Gas Specialist is a credential based on 24 hours of classroom instruction on the requirements of NFPA 99. This credential is ideal for anyone involved in medical gas design. Project managers and bid estimators would also see value in this training.
- ASSE 6010 Medical Gas Installer requires a 32-hour course of instruction covering installation requirements and documenting the installer's ability to braze piping.
- ASSE 6020 Medical Gas Inspector is a 24-hour course with similar instruction to the ASSE 6005 credential and is targeted at anyone who will be involved in the physical inspection of the piping project. Ideal candidates are the AHJs, contractors, designers, verifiers and hospital personnel who will perform hands-on inspections.

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Medical gas

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• ASSE 6030 Medical Gas Verifier involves a 32-hour course of instruction available after a two-year internship. It is tailored to the people who will perform verification, inspection and testing on the project, to ensure by a documented procedure that all applicable requirements of NFPA 99 have been adhered to and system integrity has been achieved or maintained. Complete documentation from the verifier is required prior to the healthcare staff releasing the systems for patient use.

• ASSE 6040 Medical Gas Maintenance is a 32-hour course of instruction for personnel who maintain these systems; the ideal candidates are hospital maintenance personnel and field service technicians. NFPA 99 (2012) has an updated list of the routine maintenance services that are required to keep the medical gas delivery system functioning efficiently.

• ASSE 6050 Medical Gas Instructor is a 40-hour course of instruction developed for the people who teach and credential the above. The instructor will develop and deliver the proper training, tailored to the specific user's needs.

If you start with a good understanding of NFPA 99 requirements and require that all involved in the project are credentialed to the appropriate standards, you can look forward to a smooth project. I also recommend that you use ASSE 6030 verifiers who have upgraded their credential through the Medical Gas Professional Healthcare Organization (MGPHO). Specify MGPHO CMGV as the verifier on all of your projects. The MGPHO website (mgpho.org) contains an excellent online forum to help answer your questions about medical gas.

What does a medical gas verifier do?

The verifier is responsible for inspecting and testing all new piped medical gas systems, additions, renovations, temporary installations or repaired systems to ensure, by a documented procedure, that all applicable provisions of NFPA 99 have been adhered to and system integrity has been achieved or maintained.

Medical gas inspectors are required to maintain a log book that contains records of site observations and test results. Test and inspection reports also are required as the project progresses. The verifier shall personally witness the various tests and record and verify the results of any tests performed by the installer, including:

- Visual inspection of brazed and welded joints
- Inspection of all welded test coupons
- Initial blowdown and pressure test
- Cross-connection tests
- Standing pressure and vacuum tests
- Piping purge test
- Final verification report

In addition to verifying that certain documents are on file at the jobsite, such as the building permit, shop drawings and manufacturers' literature, the medical gas verifier shall confirm the following:

- Proper handling and installation of materials and supports
- Use of proper piping materials and joining methods
- Labeling and identification
- Proper purge procedure
- Installation of manifolds, medical vacuum sources, medical compressed air sources, bulk medical gas supply sources and alarm panels

Verification testing

Before testing begins, the verifier must record certain information about the medical gas and vacuum systems, including the location of source equipment, zone valves, all outlets and inlets, alarm panels and the emergency oxygen supply connection.

The verifier performs and documents the following tests on all medical gas and vacuum source equipment and distribution systems, using either nitrogen NF or the system gas. The source gas typically is used on small projects when using nitrogen NF is impractical.

- Standing pressure test for positive pressure gases
- Standing vacuum test for vacuum systems
- Verification tests for cross-connections, including individual pressurization, pressure differential, shutoff valve, master, area, and local alarms, piping purge, final tie-in, operational pressure and medical gas concentration
- Medical air purity test for compressor systems
- Labeling of system components
- Medical air compressor system test
- Medical gas supply source tests
- Medical/surgical vacuum systems test

Testing equipment

The equipment the verifier uses includes the following:

- Pressure gauges/transducers cleaned for oxygen service with an accuracy of ±1.5 pounds per square inch gauge (psig) or better for pressures up to 100 psig and ±3 psig for pressures from 100–300 psig
- Vacuum gauge/transducer with a range of 0–30 inches of mercury (in. hg) and an accuracy of ±1 in. hg
- Direct-reading flow meter/flow sensor with an accuracy of ±3 percent (or better) of the full-scale reading of the gauge/indicator

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What is a medical gas?

The term medical gas can be used to describe any of the following:

- Oxygen, used to support or supplement patient respiration
- Medical air, used for mechanical ventilation, respiratory treatments, and neonatal support
- Nitrous oxide, used as a relative analgesia and for anesthesia support
- Carbon dioxide, used for insufflation (blowing a powder, vapor, or gas into a body cavity)
- Medical surgical vacuum, used to remove bodily fluids from patients
- Helium, used for perfusion (injecting fluid into a blood vessel)
- Support gases, including nitrogen to drive tools and instrument air for any medical support purpose

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• Gas/vacuum-specific adapters

• Oxygen analyzer with a range of 0–100 percent and a rated accuracy of ±3 percent or better

• Nitrous oxide analyzer with a minimum range of 95–100 percent and a rated accuracy of ±1 percent or better

• Nitrogen analyzer with a minimum range of 95–100 percent and a rated accuracy of ±1 percent

• Carbon dioxide analyzer for low-level CO2 with a range of at least 0–600 parts per million (ppm); for 99 percent or better with a minimum range of 95–100 percent and a rated accuracy of ±3 percent; and for carbon dioxide and oxygen mixtures shall have a range of 0–1 percent CO2 greater than the maximum CO2 level and a rated accuracy of ±3 percent

• Carbon monoxide analyzer with a range of at least 0–20 ppm and a rated accuracy of ±1 ppm of CO or better

• Analyzer for total hydrocarbons (as methane) with a range of at least 0–100 ppm and a rated accuracy of ±1 ppm total hydrocarbons or better

• Analyzer for halogenated hydrocarbons with a range of at least 0–5 ppm and a rated accuracy of ±1 ppm total hydrocarbons or better

• Dew point analyzer with a range of at least -76°F to 68°F (-60°C to 20°C) and shall read within a rated accuracy of ±5°F (±3°C) (or better) pressure dew point and read the dew point at 50 psig

• A pressure-tight metal or plastic device that holds a filter element in the proper position for sampling and large enough to permit the flow of 100 liters per minute (3.5 scfm) through the proper filter

• Clean, environmentally stabilized, pre-weighed, 0.45-micron filters pre-weighed on a microbalance accurate within 0.1 milligrams

I enjoy nothing better than a smooth project from start to finish. That is why I have dedicated the last 10 years to training and consulting with all of the players, from equipment manufacturers to designers and owners. Many design firms and contractors are now specializing in healthcare construction, and this specialization is a considerable aid to these complex projects. I hope you will consider the verifier an integral part of this process. ■

***Richard L. Miller, CMGI**, is president of Medical Gas Training & Consulting LLC, a company focused on advancing medical gas system projects. He is a founding member, former president, and current vice president of Credentials of the Medical Gas Professional Healthcare Organization, and he is certified by this organization as a Credentialed Medical Gas Verifier. He also holds credentials from National Inspection Testing Certification Corp., meeting the requirements of ASSE 6010: Medical Gas Installer, ASSE 6020: Medical Gas Inspector, ASSE 6030: Medical Gas Verifier and ASSE 6050: Medical Gas Instructor.*