

MEASUREMENT OF ANESTHETIC AGENTS IN OPERATING ROOMS



Figure 1: Measurements of anaesthetic agents inside the operating room

The Opportunity

Monitoring exposure to anesthetic gases is critical when evaluating the air quality and the ventilation efficiency of the operating room.

Anaesthetic agents are chemicals that produce general anaesthesia when breathed. General anaesthesia is a state of complete insensitivity or unconsciousness. Surgical techniques, which would otherwise be impossible to practice, have become common because patients are protected from pain by anaesthesia.

Patients treated with anaesthetics are only briefly exposed, but those who work regularly with or near anaesthetics such as surgeons, anesthesiologists, nurse anesthetists, operating room nurses and technicians, may be at risk. Exposure comes from unused fresh gases released from the anaesthetic delivery system and from waste gases exhaled by patients.

Another important aspect is the efficiency of the ventilation system and its capability to remove the anaesthetic agents in the operating room. The agent levels should be checked continuously.

The Monitoring Need

Legislation and enforcement in this field varies greatly from country to country. For example, in Italy, the law requires extensive monitoring of anesthetic gases in operating rooms and frequent measurements on the ventilation system.

The anesthetic gases that usually are monitored are Nitrous Oxide, Isoflurane, Enflurane, Sevoflurane and Desflurane. Carbon Dioxide (CO₂) and Isopropanol are also monitored in order to cross-compensate for interferences. CO₂ is also used as an indicator of the air quality and the ventilation efficiency in the operating room.

In addition to the continuous monitoring of the operating room, the adjacent pre-anesthesia room and recovery room are also monitored.

Figure 2: The INNOVA 1512 Photoacoustic Gas Monitor and INNOVA 1409 Multipoint Sampler unit are connected to the computer via LAN allowing full remote control.

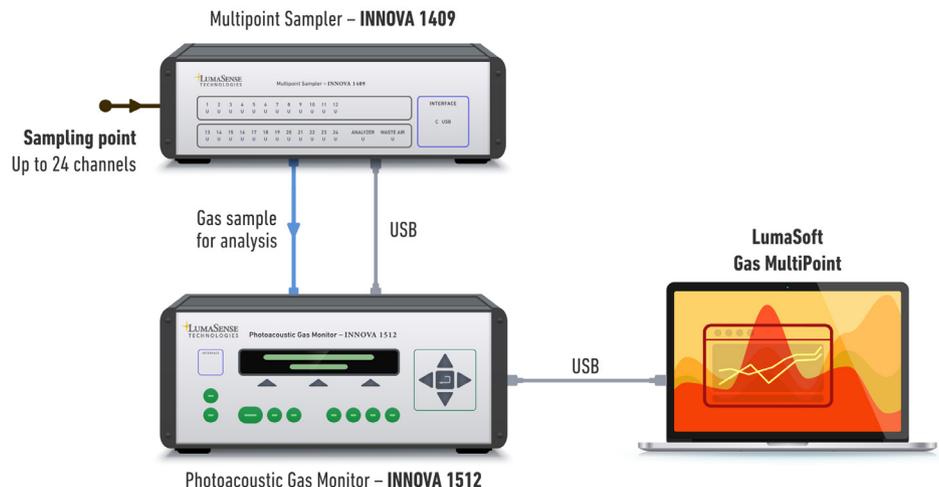




Figure 3: INNOVA 1512 Photoacoustic Gas Monitor.

Our Solution

The INNOVA 1512 Photoacoustic Gas Monitor is well suited for this type of measurement. The monitor is easily operated and can measure up to five gases at a time, which would include anesthetic agents of interest and CO₂.

The measurement results are automatically compensated for water vapor, which is measured with a separate filter. The advantage of the Photoacoustic Gas Monitor – INNOVA 1512 is its high stability and repeatability with infrequent calibration (typically once a year), linear response, low detection limits, and no consumables.

The detection limits for the Photoacoustic Gas Monitor – INNOVA 1512 for the gases of interest are:

- 0.03 ppm for Nitrous Oxide
- 0.008 ppm for Desflurane
- 0.005 ppm for Isoflurane
- 0.006 ppm for Sevoflurane
- 1.5 ppm for CO₂
- 0.005 ppm for Enflurane

Tested Technique

When combined with the 1409 Multipoint Sampler unit, the system can obtain samples from multiple operating rooms, pre-anesthesia rooms, and wake-up rooms with two measurement points in each room. Thanks to the LumaSoft Gas Multi Point 7880 software, a detailed picture of the anesthetic gas concentration can be obtained for each single location 24 hours a day.

Figures 4 and 5 show the concentration of Nitrous Oxide and Sevoflurane at the two sampling points in an operating room. The first peak at around 7:35 is related to the test of the respiratory system before the operation. All measuring data is stored in a SQL server database and remote control capability is available due to the TCP/IP interface built into the INNOVA 1512.

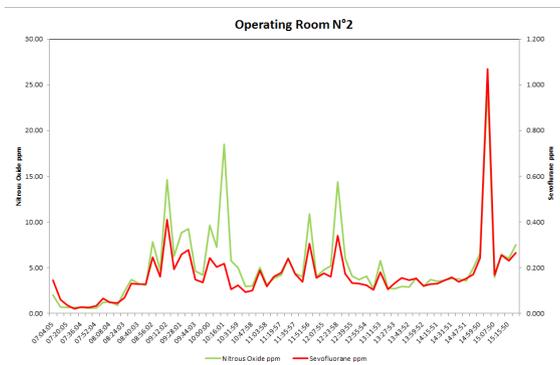


Figure 4: Measurements of Nitrous Oxide and Sevoflurane in an operating room.

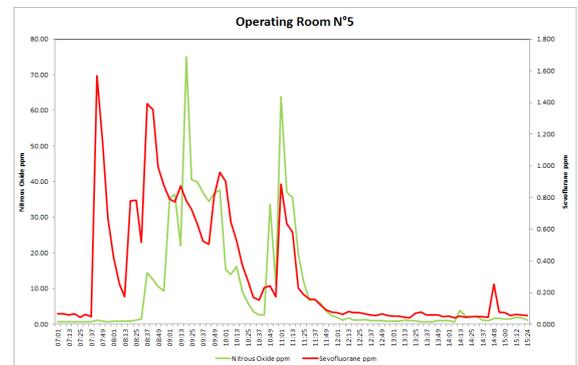


Figure 5: Measurements of Nitrous Oxide and Sevoflurane close to the anaesthetist.



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