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# Clearing the air: Surgical smoke and workplace safety practices

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Workplace hazards are not new to the surgical suite where there's the potential for fires, eye, skin, and musculoskeletal hazards, as well as exposures to airborne biological pathogens and chemical contaminants.

Devices emitting laser beams, electrosurgical instruments, and other equipment generating smoke through the destruction, cauterization, or vaporization of tissue can potentially contribute to an increased risk of occupational illness and injury. Aerosolized contaminants emitted during the use of these devices can impact not only the surgeon and staff who work in close proximity to the smoke source (at the surgical field), but also personnel located at distances further from the source in the OR.

Over the past 30 years, the body of scientific literature detailing the potential disease-causing exposure hazards of surgical smoke has increased. However, definitive scientific evidence demonstrating the causative link between occupational exposure to surgical smoke and resultant disease is still evolving. Reviews on this topic suggest there's a need for continued adoption of recommended work control practices to decrease the potentially harmful health effects of smoke plume exposures.[1-13] (See *Historical perspective of surgical smoke contents and risks.*)

This article will review some of the seminal research studies on surgical smoke, the currently available evidence primarily focusing on the hazardous particles commonly found in surgical smoke, and the regulatory guidance to safeguard the respiratory health of workers exposed to surgical smoke.

Throughout this article, the term respirator refers to a NIOSH-approved and U.S. FDA-cleared filtering facepiece N95 respirator. This is a class of respiratory personal protective equipment (PPE) filtering at least 95% of airborne particles, including biologic agents.

## Workplace surveys

Workplace local exhaust ventilation (LEV) and ventilation controls may be the gold standard, but one has to assess their correct usage, efficacy, and whether they are correctly maintained. In an attempt to better understand workplace practices, a survey from 623 AORN respondents conducted in 2007, demonstrated that LEV was inconsistently used and apparently misunderstood.[14] Based on both anecdotal reports and the study findings, engineering controls (for example, smoke evacuators) are not often present, not used if present, or not turned on during smoke-generating procedures in the OR. The overwhelming message is that perioperative staff is exposed to surgical smoke due to lack of consistent use of smoke evacuators even during laser procedures emitting smoke-laden contaminants.

Unfortunately, the survey results also indicated very few respondents routinely used effective respiratory protection for surgical smoke. This is most troubling since only 21% of respondents reported using respirators during condyloma or dysplasia treatments, and only 17% reported using respiratory protection during electrosurgery, electrocautery, or diathermy procedures.

A follow-up, web-based survey of AORN members in late 2010 yielded 1,356 responses representing individuals in all 50 U.S. states. The findings indicate an increase in wall suction use and non-NIOSH high-filtration (laser) masks. However, the use of LEV smoke evacuators and NIOSH-approved N95 respirators changed very little.[15]

In addition, a web-based survey was undertaken by NIOSH in early 2011 to gauge the status of current recommended practices (including PPE) as well as the adoption of recommended procedures to minimize worker exposures to a variety of hazards. Workplace procedures for minimizing surgical smoke exposures was lowest of the six surveyed

## Historical perspective of surgical smoke contents and risks

Unpleasant odors, particulates, gases, and vapors are emitted during most surgical procedures using cutting and cauterizing equipment. Surgical smoke, also known as surgical plume, is generated when procedures or treatments require the use of electrosurgical devices, tissue-ablating lasers, ultrasonic scalpels, high-speed drills, burrs, and saws.[4]

The literature is brimming with studies demonstrating that surgical smoke contains a variety of biological contaminants. Respiratory irritants known to have been present in surgical smoke have been linked to asthma and infectious agents, such as human papillomavirus (HPV).[5] In addition, surgical smoke is similar to cigarette smoke in its potential toxicity to human tissue. Tomita et al. found the burning of 1 g of tissue can release the same level of mutagenic contaminants as three to six cigarettes.[6] As a route of disease transmission, intact virions (such as HIV, hepatitis B, HPV) have been found in the plume, and their infectivity has been demonstrated.[7]

Mihashi et al. vaporized animal tissue to determine the number, size, and mutagenicity of particles in the resultant smoke and the possible countermeasures to reduce the amount of emitted airborne smoke.[8] An analysis demonstrated most of the particles were smaller than 1 micrometer in diameter, and the particles displayed mutagenic activity. Other studies indicate small particles less than 1.1 micrometer in diameter constitute 77% of the particulate matter generated in surgical smoke found in electrosurgery with a mean size of 0.07 micrometer.[6]

Brüske-Hohlfeld et al. examined the production of ultrafine particles generated in surgical smoke in different surgical suites, during various procedures, with the aim of measuring the concentration of ultrafine particles. Using a condensation particle counter, they measured the number of particles in the diameter sizes of 10 nm to 1 micrometer. The findings demonstrated "very high exposure to ultrafine particles for surgeons and close assisting personnel – alternating with longer periods of low exposure."[9] The authors suggested that without adequate ventilation, the aerosolized particles would continue to accumulate, and therefore, increase the exposure of the OR staff with possibly long-term deleterious effects.

In addition, Brandon and Young found it took approximately 20 minutes for particle concentrations to return to baseline levels following the use of electrosurgery during breast reduction surgery.[10] This delay in aerosol reduction is typical of control approaches using dilution ventilation for contaminant reduction as opposed to local source control. "Dilution ventilation is not as satisfactory for health hazard control as is local exhaust ventilation (LEV)."[11]

Hallmo and Naess reported the case study of a 44-year-old surgeon's acquisition of laryngeal papillomatosis. The surgeon had treated several patients with anogenital condylomata acuminata using the Nd:YAG laser. There were no other exposure risks except for the laser treatments, during which the surgeon wore surgical masks, gloves, eye protection, and used ordinary smoke evacuators. The surgical masks may have provided an ineffective barrier to HPV because of a poor facial fit.[12]

A comparative study by Gloster et al. looked for possible differences in the incidence of HPV warts in surgeons exposed to CO2 laser plumes and two large groups of patients with warts.[13] Surgeons who were exposed to surgical laser plumes were more likely to acquire nasopharyngeal warts than the control groups. This difference was statistically significant. The authors concluded the nasopharyngeal warts were as a result of inhalation of the laser plume. The four respondents who developed nasopharyngeal warts all used smoke evacuators, laser masks, and gloves, and yet it appeared they weren't adequately protected.

work hazard categories based on 4,746 responses.[16]

## Regulatory standards and recommended practices

Many authorities and researchers recommend the use of engineering and administrative controls as the first lines of protection. For example, consistently using general room and LEV smoke evacuators and workplace controls such as keeping smoke evacuator suction hose nozzles as close to the source as possible, but no further than 2 in (5.08 cm) from the surgical site.[17] Respiratory PPE (at least as protective as an N95) should be used as secondary protection for smoke generated in the OR when engineering and administrative controls don't effectively remove the hazard. Wearing personal respirators continues to be controversial and burdensome because many believe respirators are unnecessary and choose not to wear them; however, this doesn't preclude their potential value in protecting OR staff. Surgical masks, even those claiming high-filtration capabilities or labeled as laser masks, don't suffice in preventing the inhalation of the majority of smoke particles that are smaller than 1.1 micrometer.[9,18]

A study conducted by Lee, Grinshpun, and Reponen with particles the size of viruses and bacteria (0.04-1.3 micrometer) found of the nine surgical masks tested, none provided the minimum level of respiratory protection recommended by OSHA.[19] Kunachak and Sobhon and Nezhat et al. concluded, based on the particle size ranges found in their studies of laser surgery smoke plume, the particles were too small to be effectively filtered by surgical masks and recommended the use of a smoke evacuator system.[18,20] Surgical masks don't seal to the face and may be loose, resulting in the traversal of smoke particulates around the mask into the respiratory tract of the wearer.

In the "Guidelines for Environmental Infection Control in Health-Care Facilities," the CDC recommended instituting several measures to minimize exposure to aerosol hazards in healthcare facilities.[21] These control measures include:

- mechanical LEV smoke evacuation systems with high-efficiency filters to manage the generation of large amounts of laser plume, when ablating tissue infected with HPV
- central wall room suction units with in-line filters to evacuate minimal laser plumes
- appropriate PPE, such as "N95 or N100, respirators to minimize exposure to laser plumes."

NIOSH addresses several ventilation control measures as ways to clear OR smoke.[17] These techniques include a combination of workplace controls, such as general room ventilation, which alone may not totally capture contaminants generated by smoke-emitting surgical procedures, and wall suction systems, which are less effective because they were designed primarily to capture liquids rather than particulates or gases. Although the techniques discussed above may reduce smoke contaminants, they are neither recommended nor as effective as LEV smoke evacuators. As a result, NIOSH recommends the use of LEV smoke evacuators, which contain "a suction unit (vacuum pump), filter, hose, and an inlet nozzle."[17] The capture velocity should be at 100-150 ft/minute at the inlet nozzle, and a high-efficiency particulate air filter should be used in order to effectively trap particulates generated by the laser and electrosurgical devices. Smoke evacuators are preferred over wall suction systems. It's imperative the systems be properly installed and maintained to assure their optimal functioning. To be most effective, the smoke evacuator nozzle inlet should be kept within 2 in from the surgical site to effectively capture generated contaminants.[17]

NIOSH recommendations specifically emphasize the importance of properly maintaining, cleaning, and monitoring LEV smoke evacuators and following manufacturer directions to ensure the optimal and efficient capturing capacity of generated contaminants.[17] Although NIOSH recommendations in the Hazard Control HC11: control of smoke from laser/surgical procedures do not specifically address the use of N95 respirators, the respirators do protect the wearer from particulates present in the air through their filtration efficiency and fit.[17] OSHA requires N95s must be fit tested to assure a tight fit to minimize particulates bypassing the respirator and entering the wearer's breathing zone.[22]

OSHA recognizes the use of a laser or electrosurgical device for the thermal destruction of tissue

creates a smoke byproduct.[23] According to OSHA, approximately 500,000 workers, including surgeons, nurses, anesthesia providers, and surgical technicians, have prolonged daily exposures that could be cumulative over the course of a surgical career.[23] At this time, OSHA hasn't issued a comprehensive laser standard for the healthcare sector.

## OSHA's general duty clause

The general duty clause, Section 5(a)(1) of the Occupational Safety and Health Act of 1970, applies to all employers and requires each employer to provide employees with a place of employment, which is free from recognized hazards capable of causing serious physical harm. This provision can only be cited where there is a serious and recognized hazard in the workplace, which can be feasibly abated.[24]

## Laser-generated airborne contaminants

In surgical procedures using lasers that vaporize tissue through disruption of cells, laser-generated airborne contaminants (LGAC) result as an airborne hazard requiring appropriate management. Analysis of these contaminants produced during laser surgical procedures has shown the presence of:

- Gaseous toxic compounds
- Bioaerosols
- Dead and live cellular material
- Viruses.

In orthopedics, dentistry, plastic surgery, and other fields, it is also possible to generate particulates and metal fumes. At certain concentrations some of the LGAC may cause ocular and upper respiratory tract irritation, have unpleasant odors, create visual problems for the user, and have been shown to have mutagenic and carcinogenic potential. Laser smoke production increases irradiance levels. Therefore, laser surgical procedures requiring high irradiance levels are more likely to produce LGAC.

**Possible solutions**

- Airborne contaminants should be controlled by the use of local exhaust ventilation, respiratory protection, or a combination of both.[22,26]

Therefore, there are no requirements for the use of engineering controls or respirators for protection from surgical smoke. However, the general duty clause may be applied even where a particular hazard is not addressed by any OSHA standard.[24] (See *OSHA's general duty clause.*)

There is evidence that LEV smoke evacuators effectively capture smoke-generated contaminants. But these workplace controls often are not available, maintained, or turned on, thus, providing no protection because they are not used.[14-16]

OSHA's "Health Hazard Information Bulletin: Hazard of Laser Surgery Smoke" states "when performing laser therapy on patients infected with viruses such as hepatitis or HIV, the smoke plume should be assumed to be infectious, and appropriate precautions, such as a well maintained vacuum apparatus should be observed."[25]

OSHA requires respirators be used to protect employee's health in situations where engineering controls and "work practices" are not feasible, where such controls have not been instituted, in emergencies, or where such controls are not sufficient, by themselves, to protect the health of employees.[26] (See *Laser-generated airborne contaminants.*)

The American National Standards Institute (ANSI) standard Z136.3 (2011) Safe Use of Lasers in Health Care, recommends the use of general room air ventilation techniques, LEV, or a combination. General ventilation is not viewed as adequate, since it "may allow contaminants to escape into breathing zones."[27] ANSI further recommends when smoke plume is anticipated the healthcare facility "shall implement policies and procedures for the control of the hazard."[27] "Appropriate LEV techniques are the first line of defense, and surgical masks are not designed to provide protection from plume contents."[27]

The Joint Commission's Environment of Care, Element of Performance for Standard EC.02.02.01 for hospitals, makes specific mention of hazardous energy sources, including lasers and other sources. The standard requires the "hospital minimizes risks associated with selecting and using hazardous energy sources."[28]

In the electrosurgery and laser safety sections of the 2014 *Perioperative Standards and Recommended*

*Practices,* AORN states "that surgical smoke should be removed by use of smoke evacuation—primarily LEV."[29] In addition, personnel should consider wearing respiratory protection "that is at least as protective as a fit-tested surgical N95 filtering face piece respirator, in conjunction with LEV, in potential disease transmissible cases (human papillomavirus) and during high-risk or aerosol transmissible disease procedures."[29]

Although AORN does discuss the use of "high-filtration surgical masks," it categorically states these face masks "should not be used as the first line of protection against surgical smoke inhalation or as protection from chemical or particulate contaminants found in surgical smoke plume. . . A high-filtration mask provides less protection than a fit-tested N95 filtering face piece respirator."[29]

As with any protective device, the proper use and maintenance of respirators are essential to both minimize the wearer's exposure to potentially hazardous contaminants and to assure the device functions to provide the optimal protection.

The use of respirators is warranted in those circumstances where engineering and administrative (such as work practice) controls can not be used to reduce airborne contaminants. Respirators must be used as part of a complete respiratory protection program, which includes a clear definition of the anticipated hazards, the level of respiratory protection required, the proper selection and fitting of the respirators for the individuals exposed to the contaminants, and seal checking every time a respirator is to be worn. Every worker required to use a respirator must have a medical evaluation to assure that it is safe for the employee to use the device. Potentially exposed employees are to be trained on the correct use and care of respirators to understand the importance of correct donning, doffing, and discarding of used devices.[22]

The updated 2013 Plume Scavenging (CSA Z305.13-13) standard includes the statements that PPE should not be used as the "primary method of protection against occupational exposure to plume" and "surgical masks provide minimal protection against plume."[30] The Canadian Centre for Occupational Health and Safety (CCOHS) also states LEV controls should be used as primary controls along with adequate respiratory protection, including evidence of a personal protection program.[31] (See *Resources.)*

## Debate continues over the role of respiratory PPE

There are controversies about the best way to mitigate a hazard. While there may not be universal agreement for wearing respirators, as debate continues, the prudent position should be to recommend the best protection for OR staff until substantial evidence demonstrates otherwise.

### Resources

- **Making Things Clear:** www.lina-medical.com.pl/files/34/penetration_brochure.pdf
- **OSHA Hospital e-tool-PPE:** www.osha.gov/SLTC/etools/hospital/hazards/ppe/ppe.html
- **Respiratory Protection Standard:** www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards
- **Canadian Centre for Occupational Safety and Health Occupational Health and Safety Laser Plumes - Health Care Facilities (2014):** www.ccohs.ca/oshanswers/phys_agents/laser_plume.html
- **Lasers-Health Care Facilities (2013):** www.ccohs.ca/oshanswers/phys_agents/lasers.html
- **Pfeidler:** www.pfiedler.com/ce/1148/files/assets/common/downloads/Managing%20Surgical%20Smoke%20Plume.pdf
- **OSHA Laser and Electrosurgical Plume Standards:** www.osha.gov/SLTC/laserelectrosurgeryplume/index.html
- **CDC/NIOSH HC11 Hazard Control of Smoke From Laser/Electrosurgical Procedures:** www.cdc.gov/niosh/docs/hazardcontrol/hc11.html
- **AORN Surgical Smoke Tool Kit:** www.aorn.org/Clinical_Practice/ToolKits/Surgical_Smoke_Evacuation_ToolKit/Management_of_Surgical_Smoke_Tool_Kit.aspx

"Scientific uncertainty can act as a barrier to adopting preventive measures...however, where there is a reasonable suspicion that a risk exists from exposure . . . prudent action should defer to a precautionary approach. A precautionary approach is reasonable in cases where there exists biological plausibility that an exposure presents a threat to human health, despite the presence of scientific uncertainty, and especially when there are safer alternatives available."[32]

Given the cumulative evidence, over an extensive period of time, there is sufficient justification to be cautious and consider the precautionary use of respirators when working with or near smoke-generating equipment. Perioperative staff is encouraged to discuss these issues with management and improve workplace protocols and daily practices.

While the overarching recommendations are to assure LEV smoke evacuation systems are in place and in proper working condition, it has been well documented that these devices may not always be present, working properly, or even be turned on. Given the recommendations of various regulatory and standards setting organizations to adopt safer smoke control LEV procedures as the primary control measure and PPE practices as a secondary control measure, it is worrisome that daily practice improvements appear to be lagging. While the definitive evidence is building, it is the best practice to consistently reduce smoke plume exposures minimizing the hazard and potential health effects. **OR**

REFERENCES


1. Benson SM, Novak DA, Ogg MJ. Proper use of surgical N95 respirators and surgical masks in the OR. *AORN J.* 2013;97(4):457-467.

2. Pierce JS, Lacey SE, Lippert JF, Lopez R, Franke JE. Laser-generated air contaminants from medical laser applications: a state-of-the-science review of exposure characterization, health effects, and control. *J Occup Environ Hyg.* 2011;8(7):447-466.

3. Mellor G, Hutchinson M. Is it time for a more systematic approach to the hazards of surgical smoke? Reconsidering the evidence. *Workplace Health Saf.* 2013;61(6):265-270.

4. King B, McCullough J. NIOSH health hazard evaluation report. HETA #2000-0402-3021. *Inova Fairfax Hospital, Falls Church, Virginia.* Cincinnati, OH: National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention; 2006.

5. Barrett WL, Garber SM. Surgical smoke: a review of the literature. Is this just a lot of hot air? *Surg Endosc.* 2003;17(6):979-987.

6. Tomita Y, Mihashi S, Nagata K, et al. Mutagenicity of smoke condensates induced by $CO_2$-laser irradiation and electrocauterization. *Mutat Res.* 1981;89(2):145-149.

7. Alp E, Bijl D, Bleichrodt RP, Hansson B, Voss A. Surgical smoke and infection control. *J Hosp Infect.* 2006;62(1):1-5.

8. Mihashi S, Ueda S, Hirano M, Tomita Y, Hirohata T. Some problems about condensates induced by $CO_2$ laser irradiation. In: *4th Congress of the International Society for Laser Surgery*. Tokyo, Japan: Japan Society for Laser Medicine; 1981:2.25-22.27.

9. Brüske-Hohlfeld I, Preissler G, Jauch KW, et al. Surgical smoke and ultrafine particles. *J Occup Med Toxicol.* 2008;3:31.

10. Brandon H, Young L. Characterization and removal of electrosurgical smoke. *Surg Serv Manage.* 1997;3(3):14-16.

11. American Conference of Governmental Industrial Hygienist. *General Industrial Ventilation in Industrial Ventilation: A Manual of Recommended Practice for Design.* 27th ed. OH: Signature Publications; 2010:4-2.

12. Hallmo P, Naess O. Laryngeal papillomatosis with human papillomavirus DNA contracted by a laser surgeon. *Eur Arch Otorhinolaryngol.* 1991;248(7):425-427.

13. Gloster HM Jr, Roenigk RK. Risk of acquiring human papillomavirus from the plume produced by the carbon dioxide laser in the treatment of warts. *J Am Acad Dermatol.* 1995;32(3):436-441.

14. Edwards BE, Reiman RE. Results of a survey on current surgical smoke control practices. *AORN J.* 2008;87(4):739-749.

15. Edwards BE, Reiman RE. Comparison of current and past surgical smoke control practices. *AORN J.* 2012;95(3):337-350.

16. Steege AL, Boiano JM, Sweeney MH.NIOSH health and safety practices survey of healthcare workers: training and awareness of employer safety procedures. *Am J Indust Med.* 2014. wileyonlinelibrary.com.

17. National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention. Hazard control (HC11): control of smoke from laser/electric surgical procedures (Publication No. 96-128).

18. Kunachak S, Sobhon P. The potential alveolar hazard of carbon dioxide laser-induced smoke. *J Med Assoc Thai.* 1998;81(4):278-282.

19. Lee SA, Grinshpun SA, Reponen T. Respiratory performance offered by N95 respirators and surgical masks: human subject evaluation with NaCl aerosol representing bacterial and viral particle size range. *Ann Occup Hyg.* 2008;52(3):177-185.

20. Nezhat C, Winer WK, Nezhat F, Nezhat C, Forrest D, Reeves WG. Smoke from laser surgery: is there a health hazard? *Lasers Surg Med.* 1987;7(4):376-382.

21. Sehulster L, Chinn RY; CDC; HICPAC. Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR Recomm Rep.* 2003;52(RR-10):1-42

22. Occupational Safety and Health Administration. General industry standard, occupational safety and health standards, respiratory protection. 29 CFR 1910, Subpart I 1910.134.

23. Occupational Safety and Health Administration, Department of Labor. Safety and Health Topics: Laser/Electrosurgery Plume. 2007. http://www.osha.gov/SLTC/laserelectrosurgeryplume/index.html.

24. Occupational Safety and Health Act of 1970, Pub. L. No. 91-596, § 5(a)(1) 1970. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3359.

25. Occupational Safety and Health Administration. Department of Labor. OSHA hazard information bulletins: hazard of laser surgery smoke. 1988. http://www.osha.gov/dts/hib/hib_data/hib19880411.html.

26. Occupational Safety and Health Administration, Department of Labor. Hospital etool: surgical suite: use of medical lasers. http://www.osha.gov/SLTC/etools/hospital/surgical/lasers.html.

27. American National Standards Institute. *American National Standard for Safe Use of Lasers (ANSI Z136.3 2011).* Orlando, FL: Laser Institute of America; 2011.

28. The Joint Commission. The Joint Commission Comprehensive Accreditation and Certification Manual CAMH Update 1, July 2014, Oakbrook Terrace.

29. AORN. *Perioperative Standards and Recommended Practices.* 2014 ed. Denver, CO: AORN; 2014.

30. CSA Standards Association. *Plume Scavenging in Surgical, Diagnosic, Therapeutic, and Aesthetic Settings (CSA Group Z305.13-13).* Ontario, Canada; December 2013.

31. Canadian Centre for Occupational Helath and Safety (CCOHS). Laser Plumes–Health Care Facilities. 2009-06-04.

32. NORA Healthcare and Social Assistance Sector Council, National Institute for Occupational Safety and Health. *State of the Sector-Healthcare and Social Assistance: Identification of Research Opportunities for the Next Decade of NORA. Publication no. 2009-138.* Atlanta, GA: National Institute for Occupational Safety and Health; 2009. http://www.cdc.gov/niosh/docs/2009-139/pdfs/2009-139.pdf.

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