

Surgical Smoke Dangers in the OR

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OR nursing is a high-pressure, high-reward profession. It involves holding your patient's hand and providing comfort as they fall into a drug-induced sleep before intubation. It's about quickly anticipating the surgeon's needs when they snap their fingers. It may require running to obtain platelets or fresh frozen plasma during a trauma.

OR nurses advocate for their patients and protect their safety. They ensure the crucial pre-surgical checklist is conducted and account for all surgical items. Ultimately, an OR nurse is part of a team of highly skilled and dedicated professionals caring for patients in surgery. However, the job should never include the inhalation of surgical smoke.

What Is Surgical Smoke?

In approximately 90% of all surgeries, energy-based surgical equipment generates [surgical smoke](#)¹. One of the main sources of smoke in surgical settings is surgical electrocautery, which has been pervasive in ORs and surgery centers since its introduction in 1926². Electrocautery includes electrical surgical pencils (often called "[bovies](#)" after their proponent William Bovie) and other powerful devices that cut and coagulate a patient's tissue. These tools and surgical lasers, introduced into surgery in the 1960s, provide precise cuts that seal blood vessels to control bleeding and reduce the risk of infection. In the process, they heat and rupture the targeted cells, dispersing aerosolized particles as

surgical smoke.

Surgical smoke contains 95% water and 5% cellular debris which allows the smoke to serve as the vector for particles potentially containing aromatic hydrocarbons (hydrogen cyanide, toluene, benzene, xylene), viruses (HPV, HIV, and HBV) viable cancer cells, carbonized tissue, blood fragments, [bacteria](#)⁴, and, [non-viable particles](#)⁵. There are [150](#)⁶ chemicals found in surgical smoke, [16](#)⁷ of which are listed as The Environmental Protection Agency's (EPA) priority pollutants.

What About Personal Protective Equipment (PPE)?

Surgical masks were designed to protect the patient from the OR staff, not vice versa. Standard OR surgical masks only filter particles of 5 µm and larger. According to The Occupational Safety and Health Administration (OSHA), [N95](#)⁸ filtering facepiece respirators, when worn correctly, filter 95% of airborne particles of 0.3 µm and larger.

The nanoparticles that comprise 80% of surgical smoke are less than 0.1µm. Knowing this, it's clear: surgical masks and N95s are not enough protection from dangerous surgical smoke particles.

Surgical Smoke Impacts Everyone in the OR

No one in an OR is protected from the hazards of surgical smoke, including sick transplant patients receiving a lifesaving organ, newborns delivered via c-section, or any of the myriad personnel who spend their days caring for the patients in the OR.

Depending on their size, these hazardous particles get trapped in the nose, pharynx, trachea, bronchioles, or alveoli, causing inflammation that can lead to [emphysema, asthma, and chronic bronchitis](#)¹⁰. Incidentally, OR nurses have [twice](#)

[the prevalence](#)¹¹ of respiratory disorders as the rest of the population.

Acknowledging the Problem

The Association of periOperative Registered Nurses (AORN) has been championing the health risks of surgical smoke inhalation for decades. Their evidence-based 2017 AORN Guidelines for Surgical Smoke Safety detail the hazards of surgical smoke with recommendations on its [evacuation](#)¹².

The 1996 National Institute for Occupational Safety and Health ([NIOSH](#)¹³) states:

"During surgical procedures using a laser or electrosurgical unit, the thermal destruction of tissue creates a smoke by-product. Research studies have confirmed that this smoke plume can contain toxic gasses and vapors such as benzene, hydrogen cyanide, and formaldehyde, bio-aerosols, dead and live cellular material (including blood fragments), and viruses. At high concentrations the smoke causes ocular and upper respiratory tract irritation in health care personnel..."

Yet, 28 years later, we have no national surgical smoke regulations.

[OSHA](#)¹⁴ states that surgical smoke "may contain toxic gases that have the potential for adverse health impacts, such as mutagenic and carcinogenic impacts." Further, OSHA advises that surgical smoke "may act as a vector for cancerous cells that may be inhaled by the surgical team and other exposed individuals."

One of [OSHA's](#)¹⁵ "recognized controls and work practices" is to "(e)vacuate all smoke, no matter how much is generated." Still, there is no requirement or enforcement of surgical smoke evacuation.

The Joint Commission (TJC), accrediting over 22,000 healthcare organizations and programs in the US, recognizes and recites NIOSH's description of the contents of surgical smoke in its Quick Safety

ISSUE 56. The [TJC](#)¹⁶ cites other research, explaining that the nanoparticles in surgical smoke can:

- “Enter a person’s blood and lymphatic circulatory systems, and travel to various distant organs”
- “Transmit viable bacteria and human papillomavirus”
- “Can cause invitro mutations and be a contributing factor to higher rates of pregnancy complications for female surgeons.”

But, like OSHA, TJC does not mandate that surgical smoke be evacuated.

Evacuating surgical smoke at its origin is the most effective method of safeguarding all individuals in the operating room, as mandated by the 2024 National Fire Protection Agency ([NFPA](#)¹⁷) standard. It states that “all medical plumes (i.e., surgical smoke) generated by the use of energy devices (e.g. electrosurgical units, lasers) during medical and surgical procedures shall be captured as close as possible to the point of generation (i.e., point where the energy device contacts the tissue)...”

Who Supports Smoke Evacuation in the OR?

The American College of Surgeons ([ACS](#)¹⁸), The Society of American Gastrointestinal and Endoscopic Surgeons ([SAGES](#)¹⁹), and The American Association of Gynecologic Laparoscopists ([JMIG](#)²⁰) all recognize the hazards of surgical smoke and recommend smoke evacuation.

Dr. Anthony Hedley, a brilliant and healthy orthopedic surgeon from Phoenix, Arizona, developed idiopathic pulmonary fibrosis that he attributed to the effects of surgical smoke in an article entitled, “[Surgical Smoke Nearly Killed Me](#)²¹.”

[Julie Greenhalgh](#)²², BSN, RN, CNOR, developed chronic lung disease, which she attributes to being an OR nurse for over 40 years. In 2005, she began advocating for laws requiring surgical smoke evacuation. While testifying on her condition,

she displayed a plastic bag containing the three inhalers she required daily for chronic coughing, bronchitis, and asthma. She was instrumental in championing the nation’s first surgical smoke evacuation bill in Rhode Island in 2018.

Georgia was the eighth state to enact legislation in 2022, but it was too late for [Angela Hohn](#)²³, RN, BSN, BS, CNOR, FCN, who dedicated 43 years to working in the OR. Angela was an avid runner who embraced a healthy lifestyle. After being diagnosed with Stage 4, non-small cell lung cancer, she joined the fight for smoke evacuation legislation. Even with Angela’s testimony, it took three years for Georgia to pass surgical smoke evacuation legislation.

Surgical smoke poses a serious health risk, and organizations such as TJC, NIOSH, and OSHA recommend evacuation. However, because no national directive exists, we must lobby for state legislation. Currently, only eighteen states have enacted laws mandating surgical smoke evacuation.

As nurses, our duty to our patients is intrinsic to our identity as healthcare professionals. Moreover, Provision 5 of the Code of Ethics for Nurses emphasizes the importance of self-responsibility, stating that “nurses owe the same duties to themselves as to others, including the responsibility to promote health and safety.” With this understanding, we must stand together to advocate for our patients’ safety and support state legislation promoting a safe work environment.

Let’s unite as South Carolina nurses to champion this essential legislation in our state. Your support is crucial to protecting everyone in our ORs. Join forces with your fellow nurses and promote health and safety by sharing your information in this brief survey. Together, we wield the power to enact positive change. <https://www.scnurses.org/page/SurgicalSmokeSurveySeptember2024>. ■

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