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Sarasota, Fla.**

**In your quest for safer surgery,  
here's how to convince your  
surgeons to actually use the  
smoke evacuation devices  
you've purchased.**

**N**asty. There's no other way to describe the awful stench of surgical smoke. Eau de Seared Flesh. And they've yet to invent the mask that can protect you from those noxious plumes. The harm to your lungs? One study likened the smoke from burning one gram of tissue to smoking three cigarettes. Uhh, no thanks. We're trying to cut back.

You can build a strong case for purchasing the best protection available, a freestanding smoke evacuator for \$1,600 to \$4,000, but your work isn't over yet. You still need to convince your surgeons to actually use the machines. Read on so that your smoke evacuator does what it's intended to do — rid your OR of noxious fumes — and doesn't wind up buried in some closet.

Gail Carpenter

Let's not be too hard on our surgeons. You can't blame them

for being suspicious about yet another contraption they could trip over on the OR floor.

After all, they've been working for years with smoke from a laser or electrosurgical unit (ESU) billowing around them protected by nothing more than a common surgical mask. When you warn them about the smoke, they might point out they're closer to it than anyone else. If they aren't complaining, why should you?

Well, not so long ago cars

came without seatbelts, and syringes came without guards, and we didn't complain about that, either. But times have changed. We found out more about the risks and we reconsidered our stance.

If he's willing to hear you out, you might also gently remind your surgeon that while he may be closest to the plume, scrub nurses probably breathe in more of it when you consider that they tend to work a greater number of cases per week than doctors.

Fortunately, I haven't needed to campaign for protections here at the Laser and Surgical Services at Center for Sight in Sarasota, Fla., a busy, two-OR eye surgery center.





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Most of our surgeons don't use a smoke evacuator because laser eye surgery produces a minimal amount of plume. But one surgeon, John Fezza, MD, specializes in plastic surgery of

the face, which involves a fair amount of harmful smoke.

Dr. Fezza, however, never fought against buying a smoke evacuator. In fact, when our center opened in January 2001,

he brought with him a smoke evacuator he'd been using for five years. We just replaced it this year. His machine is about the size of a small wastebasket placed on its side and makes almost as much noise as a vacuum cleaner, but it goes on only when there is smoke. An assistant holds the intake tube two inches from the site of surgery to swallow the entire plume.

**Wheezing and coughing**

Dr. Fezza told me how he came to acquire his evacuator. Back when he was first using a CO<sub>2</sub> laser, he would go home at night wheezing and coughing. He said his lungs felt congested, as though he'd just puffed down a few cigarettes.

Like cigarette smoke in a bar, the smell attaches to your hair, clothes and exposed skin. The smoke can leave an irritating feeling in your nostrils and even make you nauseated.

"I really worried about having the same problems that a smoker would get, such as emphysema or lung cancer," Dr. Fezza told me. In fact, he found out that he has adult-onset asthma and needed to take strong steps to protect himself.

**How surgical smoke harms**

We're only beginning to fully understand the effect of surgical smoke. A half-million OR workers are exposed to the smoke each year, including surgeons, nurses, anesthesiologists and surgical technologists. One

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**RISK** Surgical smoke can carry dangerous bacteria and viruses, including HIV. It can produce upper respiratory irritation and may have a mutagenic potential.


**FACT** An estimated 298,000 operating room professionals are exposed to electrosurgical smoke each year in the U.S. Sadly, many existing operation room smoke evacuation systems are underutilized due to bulky handpieces that nobody likes to use.

**NEED** A smoke capture device that makes it easy to gain compliance of the surgical staff and will work with all smoke evacuation systems.

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study shows that surgical nurses may be exposed to surgical smoke for up to 90 percent of their assigned work hours.

Heating tissue to about 100°C, a laser or ESU emits a plume containing mostly water vapor. In an hour-long procedure, smoke is produced during a total of just 10 minutes to 15 minutes. But without proper evacuation, it can hang in the room for as long as 20 minutes.

Surgical plumes have contents similar to other smoke plumes, including carbon monoxide, polycyclic aromatic hydrocarbons and a variety of trace toxic gases. One study reported in the *British Journal of Surgery* showed that laser smoke contained HIV DNA that remained viable for 14 days. Researchers have also suggested that the smoke may act as a vector for cancerous cells that the surgical team could inhale.

But it's been difficult for researchers to establish a solid link between surgical smoke and illnesses. For example, it's hard to prove that an OR tech contracted emphysema from surgical smoke and not from outdoor air pollution or shared cigarette smoke. Experts on surgical smoke, however, have noted a link in at least two cases, both involving physicians who contracted pathogens.

One study cites a European doctor who contracted lesions from human papillomavirus, or HPV, a variant of genital warts, on his vocal chords. And two ophthalmologists are believed to

have contracted idiopathic thrombocytopenic purpura, a condition in which the body's immune system produces antibodies that attack and destroy platelets.

### Adequate precautions

You might think that you're already taking adequate precautions against surgical smoke, but these measures can't trap the very fine particles found in

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YOU DO  
if  
someone  
DID THIS  
in  
YOUR  
O.R. ?**

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*"There is no such thing as safe smoke... As healthcare professionals, we must be active participants in this effort. It's a matter of life and breath."  
-Vangie Dennis, RN, CNOR, CMLSO*

As an Advanced Technology Coordinator, Vangie Dennis is largely responsible for the implementation of 100% smoke evacuation usage at Gwinnett Medical Center in Lawrenceville, GA.

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smoke. For example, the common surgical mask is great at blocking relatively large droplets from coughing, sneezing and speaking, but not particles of less than 5 microns in diameter. The Occupational Safety and Health Administration (OSHA) states that "surgical masks used to prevent contamination of the patient are not certified for respiratory protection."

To afford some protection from smoke, OR personnel should wear special ventilated laser masks, which Dr. Fezza and his staff use in our facility.

They employ an adhesive seal around the nose and have finer filters that can trap smaller particles. But even these masks "should not be viewed as absolute protection from chemical contaminants," according to the Association of PeriOperative Registered Nurses (AORN).

People also try to suck smoke out of the room through wall units that are located in every OR, to be used primarily to remove liquids. Provided that you install an in-line filter to trap the smoke, AORN recognizes this protection when

"minimal plume is generated."

But wall units aren't powerful enough to draw out the large amounts of smoke produced in plastic surgery, for example, says Penny Smalley, a risk management consultant at Technology Concepts International in Chicago. Ms. Smalley says fat cells produce more smoke than skin, and operations like breast reductions remove a great deal of fat.

How can you tell if your wall unit or freestanding smoke evacuator is effective? AORN says if you can smell an odor, you're not capturing the smoke adequately.

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### The best protection

You can take all kinds of precautions, but the gold standard for protecting your staff against surgical smoke is a freestanding smoke evacuator with a hose that ventilates directly at the site of surgery.

Many manufacturers have refined their models so that they're smaller, quieter and easier to use. The American National Standards Institute (ANSI), a private body that identifies voluntary standards across many industries, endorses this type of machine: "Airborne contaminants shall be controlled by the use of ventilation and respiratory protection," says ANSI. "Local exhaust ventilation is used to capture airborne contaminants as near as practicable to the site of evolution to produce an





### THE DANGERS OF SURGICAL SMOKE

Several studies have shown that the surgical plume

- invades the respiratory tract with bacterial and viral contaminants;
- propels organic and inorganic chemicals into the air; and
- results in fatigue and nausea symptoms among surgical personnel and patients.



**IN A MATTER OF SECONDS** You can see the surgical smoke rising from this blepharoplasty procedure (left). Seconds later, the smoke is gone (right), having been evacuated by the suction tubing. When you change your smoke evacuator's filter (inset), you'll notice traces of dark brown sediment, which show that your evacuator is working.

effective removal rate."

Now, when you buy a laser or ESU, the assumption is that you'll need to get a smoke evacuator. They're often sold as a package. We bought our evacuator from Nidek, the Japan-based medical laser manufacturer. Our evacuator is compact: 9 inches wide by 17 inches deep by 9.5 inches high. It uses an Ultra-Low Penetrating Air (ULPA) filter, a must for capturing fine-plume particles.

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microns in diameter in a machine with the proper capture velocity, which should be 100 feet to 150 feet per minute at the inlet nozzle.

When you change your smoke evacuator's filter, you'll notice traces of dark brown sediment, a sign your evacuator is working. "That would otherwise be in your lungs," says Dr. Fezza.

The machine's powerful motor is almost as noisy as a household vacuum cleaner. That can make it hard to communicate or listen to music in the OR. But manufacturers have been taking steps to reduce the noise and have added switching

mechanisms to the machines so that they can be turned off when they're not in use. You can easily turn almost all evacuators on and off through a foot pedal, and some do it automatically whenever the laser or ESU goes on or off.

Surgeons don't welcome having another machine on the OR floor with cables to trip over, so some makers have designed evacuators that can be hung from the ceiling, with the intake hose hooked up to the surgery boom overhead.

In many cases in my own facility, someone has to hold the nozzle, which has to be at

most two inches away from the source of the smoke. But this is not a big cost for us because we use people who are in the OR already, such as the circulating nurse or the first assist, and the holding work is very intermittent. It is so much a part of what we do now that I rarely hear the old joke, "This job sucks."

At some facilities, surgeons clip the nozzle to a rigid piece in the field of surgery, such as a laryngoscope, and even the patient's surgical gown. Manufacturers also have surgical pens that can piggyback the suction nozzle, but this only works for electrosurgery and not laser surgery. Also, the hose can only be .25 inches wide, compared with 1.25 inches for the widest hose.

Another innovation is models that show when you need to change the filter, which can reduce the cost of changing after each procedure — about \$10 to \$15 each time you replace the filter and nozzle.

Smoke evacuators can also be used in laparoscopic surgery. To see what they're doing, surgeons normally release the smoke periodically through a trocar valve. Rather than let the plume into the air, the trocar valve is hooked up directly to the smoke evacuator.

### Making your case

In you want smoke protections, your first step is to talk with your surgeon or your

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immediate supervisor. If that doesn't work, talk to the administrator in a small facility or the laser safety officer in a large hospital. They'll want to know if freestanding smoke evacuators are required under federal regulations. The answer is a qualified maybe.

OSHA officials have said that you could make a case for surgical smoke protections under the agency's "general duty clause," an umbrella regulation stating that workplaces should be "free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." Also, because some living viruses have been detected in surgical smoke, OSHA officials have suggested that this area might be subject to bloodborne pathogen regulations, but this interpretation remains controversial. AORN officials and other experts say no one has successfully filed a complaint with OSHA about inadequate surgical smoke protection.

The fact is, the Centers for Disease Control and Prevention, the CDC's National Institute for Occupational Safety and Health and even OSHA itself have issued non-regulatory warnings of the hazards of surgical smoke.

AORN sets down the most comprehensive standards. "An evacuation system should be used to remove surgical smoke," an AORN recommended practice states. "Placement

of the evacuator suction ... should be as close to the source of the smoke as possible to ... maximize smoke capture and enhance visibility at the surgical site."

The job of spreading the word on surgical smoke may get easier, thanks to a new initiative among OSHA, the Joint Commission on Accreditation of Healthcare Organizations and Joint Commission Resources, a JCAHO affiliate that conducts educational programs. The groups have joined forces to educate the healthcare community on safety and health issues for healthcare

workers, including airborne hazards. They plan to provide education and compliance assistance with information and training resources.

### Clearing the air

Hopefully, this article will help you make a strong case for surgical smoke protections. Armed with study results, regulations and a firm understanding of how smoke is evacuated, you can be very persuasive. Now all you need is someone who'll listen. **OSM**

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