SURGICAL SMOKE

A Pervasive Problem
Finally Addressed
Through Legislation and Technology

Philter Technologies, Inc.

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Surgical Smoke
Health Concerns & Solutions

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Introduction

Laser, electrocautery and ultrasonic knives are used for a range of surgical applications due to the tremendous patient benefits. Each of these devices, however, creates surgical smoke which has been well documented as toxic and carcinogenic to surgical staff along with the patient. Existing solutions to remove surgical smoke are not widely used, and yet the worldwide market for surgical lasers is growing at double digit rates.

We review the use of tools that create surgical smoke (SS), note the harmful particulates in SS, and identify current solutions. In the past few years there has been a notable trend of state legislation enacted to address surgical smoke. We assess the market size and examine how PHILTER™ technology can address this pervasive health issue.

The Problem

Lasers, electrocautery and ultrasonic knives are preferred and commonly used in a wide range of surgical procedures across multiple disciplines including oncology, dermatology, dentistry, ophthalmology, cosmetology, orthopedic and many laparoscopic procedures. These tools are used in both hospitals and ambulatory surgery centers (out-patient surgery). While beneficial for the patient compared to traditional scalpels and cutting tools, when cutting tissue these advanced tools create smoke that is very harmful to both healthcare practitioners and the patient. It is well documented by the CDC, FDA, NIH and OSHA that the harmful surgical smoke from

electrocautery, lasers and ultrasonic knives contains carcinogens, toxic compounds, biomass (viruses) and mutagenic smoke.

Local exhaust ventilation (LEV) is recommended for working around surgical smoke according to the National Institute for Occupational Safety & Health (NIOSH), an agency of the CDC. And yet the prevalence of LEV in surgical settings is lacking. NIOSH reports that just 14% of healthcare survey respondents who worked within five feet of surgical smoke source reported that it was evacuated during electrosurgery, and 47% cited the same during laser surgery. Additionally, LEV was never used by 31% for laser surgery and 59% for electrosurgery.[1] This clearly demonstrates how the problem of surgical smoke is not adequately addressed.

Electrocautery, Lasers & Ultrasonic Knives in Medical Surgery

Laser light has a specific wavelength which enables it to be focused as a narrow beam and can be very precise in cutting tissue. There are different types of lasers including the argon laser, carbon dioxide laser and the YAG laser (neodymium, or yttrium aluminum garnet). Each of these lasers operate at different wavelengths and are preferred for different surgical procedures.

Electrocautery utilizes an electric current to apply heat to tissue to cut it. Ultrasound scalpels vibrate at a very high rate (55,500 times per second) which produces frictional heat to cut tissue.

The Benefits of Laser, Electrocautery and Ultrasound Knives in Surgery

Lasers are used for very precise surgical work when cutting through tissue, replacing the use of a traditional scalpel. The benefits of using lasers in surgeries include reduced blood loss, decreased postoperative patient discomfort, reducing the likelihood of wound infection, better wound healing, and the ability to accomplish complex surgical tasks.

Electrocautery seals off blood vessels during surgery, preventing blood loss and keeps the site clean. It can also be used to remove moles, warts and tumors, particularly in sensitive areas such as the brain.

Ultrasound knives are used when cutting bone for orthopedic, orthognathic (jaw and mouth) and spinal surgeries. While cutting bone tissue, ultrasound bone scalpels leave soft tissues largely unaffected, which leads to reduced bleeding, more controlled cutting and improved procedural efficacy. Ultrasonic scalpels can also seal blood vessels during laparoscopic procedures.

How Surgical Smoke Occurs

The energy generated by laser knives raises the intracellular temperatures to high temperatures (100C/212F degrees) that vaporizes the tissue and produces smoke. The surgical smoke is often not visible and has an unpleasant odor.[2]

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[1] National Institute for Occupational Safety & Health, *Healthcare Workers Still Face Surgical Smoke Hazards*, https://www.reliasmedia.com/articles/138062-niosh-healthcare-workers-still-face-surgical-smoke-hazards

[2] CDC, *Surgical Smoke Inhalation: Dangerous Consequences for the Surgical Team*, June 2020, https://blogs.cdc.gov/niosh-science-blog/2020/06/18/surgical-smoke/

Surgical smoke from electrocautery results in smaller particulates relative to lasers. Such smaller particulates can be extremely harmful because they can be more difficult to trap or dissipate and lodge deeper in the lung. Electrosurgery is used in most operating rooms to limit the loss of blood and ensure homeostatis of the patient. Surgical smoke from an ultrasonic knife increases the possibility of transferring viable cells and pathogens. Additionally, drills and saws used in orthopedic surgeries can cause surgical smoke.

Surgical Procedures that Commonly use Lasers, Electrocautery, and Ultrasonic Devices

- General surgery (tumor removal, lipoma removal, nasal surgery)
- Oncology surgery (breast surgery, tumor removal)
- Gynecological Surgery (cervical cancer, ovarian cancer, LEEP tool usage)
- Skin surgery (wart and mole removal, actinic keratosis, pre-cancerous procedures)
- Eye surgery (LASIK or PRK, cataract removal, distichiasis, trichiasis, dry eyes)
- Cosmetic surgery (remove sunspots, wrinkles, spider veins, hair, birthmarks, tattoos)
- Dental procedures (endodontic/periodontic, oral surgery)
- Laparoscopic (smoke accumulates in body cavity)

Toxic Airborne Contaminants

Surgical smoke exposes the surgical team to hazardous particulates that are carcinogenic and mutagenic (may cause damaging genetic change to inhaler). SS also may transmit tumor cells, and can cause headaches, dizziness, sleepiness, eye tearing during the procedure along with bad odor that can absorb into hair and clothing.

Common toxins in surgical smoke include:[3]

- Benzene
- Hydrogen Cyanide
- Formaldehyde
- Bioaerosols
- Dead and live cellular material (including blood fragments)
- Viruses (Hepatitis B virus, HIV, HPV, Human coronavirus)[4] [5]

A more complete list of documented toxins in surgical smoke is in Appendix A.

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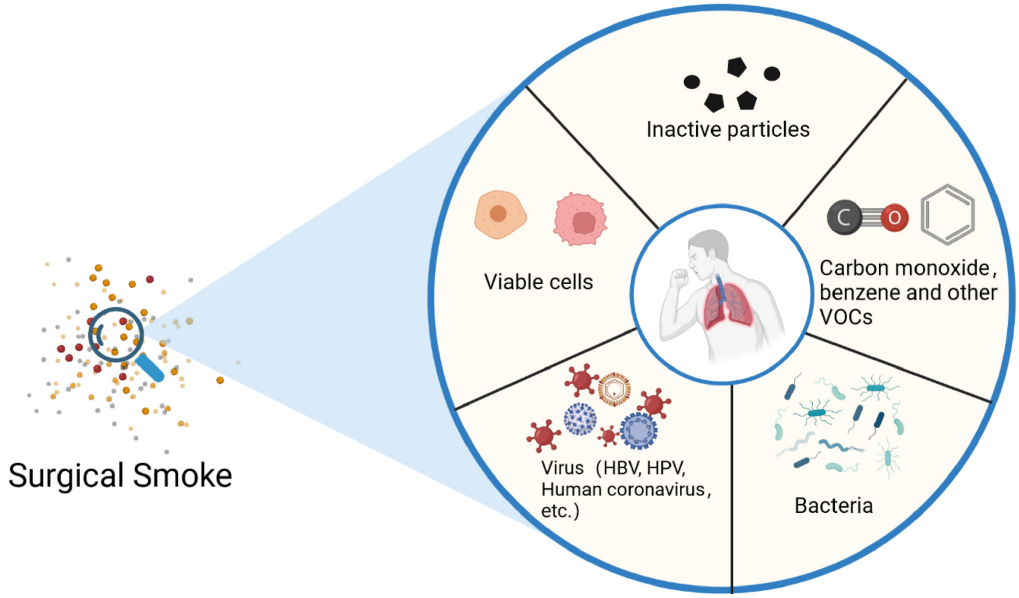
[3] American College of Surgeons, April 2021,*Where there's smoke: Quick Safety article recommends safety precautions*, https://www.facs.org/for-medical-professionals/news-publications/news-and-articles/bulletin/2021/04/where-theres-smoke-quick-safety-article-recommends-safety-precautions/

[4] The Clinical Services Journal, March 2022, *Surgical smoke inhalation: staff fear infection risk*, https://www.clinicalservicesjournal.com/story/38019/surgical-smoke-inhalation-staff-fear-infection-risk

[5] Science Direct, September 2023, *Surgical smoke: A hidden killer in the operating room*, https://www.sciencedirect.com/science/article/pii/S1015958423003731



https://www.sciencedirect.com/science/article/pii/S1015958423003731

Dozens of volatile organic compounds have been identified in surgical smoke. A common anesthetic, sevoflurane has been found in SS. Electrocautery causes an abundance of hydrocarbons, nitrifiers, fatty acids and phenols. Laser tissue ablation has more benzene formaldehyde, acrolein and polycyclic aromatic hydrocarbons. Cauterizing epidermal tissue leads to higher levels of toluene, ethylbenzene and xylene. Cauterizing adipose tissue has lower levels of toluene and higher levels of aldehydes. Carbon monoxide is generated from the incomplete combustion of tissue, which when it binds to hemoglobin, can lead to hypoxia of various organs and tissues, which shows up as headaches, dizziness and fatigue. Such symptoms can be detrimental to those responsible for successful surgical outcomes.

The size of the harmful particulates in surgical smoke has been categorized into three groups based on the tissue that is cut. Liver creates the largest particulates, skeletal muscle and renal tissue create medium sized particulates, while lung, bronchial, subcutaneous fat, skin, and cerebral gray and white tissue create small particulate matter. The smaller the particulate matter size, the deeper it travels in the human body (i.e. the alveoli of the lungs) before it is deposited. Smaller sized particulates can be more harmful than larger particulates.

Recommended Solutions for Healthcare Providers

There are no federal standards for eliminating surgical smoke for the safety of surgeons and surgical staff in operating rooms. The CDC recommends the combination of both general (room) and local (focused) exhaust ventilation. Several studies point to recommendations.

- A Dermatologic Surgery article identified a lack of recommendation for the organization of smoke evacuation systems in 2021. Studies indicate a suction evacuation system needs to be placed at 45-degree angle and within 2 – 4 inches of cauterizing procedure.[6]
- Aspirators are often used by surgical assistants to remove smoke. These aspirators must be within 5cm (approximately 2") of the place where smoke is generated to be effective. Gas flow rate must be 31-46m/minute and placed at a 45-degree angle.
- In laparoscopic surgery, the high concentration of surgical smoke that accumulates in the body (abdominal cavity usually) is discharged upon removal of an aspirator, which can be integrated with a built-in filter to eliminate the emission of harmful chemicals.
- Portable smoke evacuation devices can be used. Parameters for a successful system include a cutting angle of 45 degrees and a volume flow rate of 10,500 cubic meters/hr, or approximately 175 cubic meters/minute.

The National Institute for Occupational Safety (NIOSH), an agency of the CDC, reports the following[7]

- A smoke evacuator needs high efficiency in airborne particle reduction and a capture velocity of 100 – 150 feet per minute.
- Filters, absorbers and tubes in smoke evacuators require monitoring and replacement.
- The nozzle to attract the effluent smoke in a smoke evacuator system needs to be within 2" of the surgical site.
- At the completion of procedures, all tubing filters and absorbers must be considered infectious waste and disposed of appropriately.

<u>Smoke Evacuation Devices are Not Commonly Deployed</u>

Although the problem with SS is widely known and solution parameters have been defined, the prevalence of smoke evacuation devices (SED) was only reported by 47% of 4,533 operating staff surveyed who use laser devices in 2016.[8] For electrosurgery, the usage of SEDs was only 14%. Additionally, the 'never used' category was alarmingly high at 31% for laser use and 59% for electrosurgery.

The lack of adoption of SEDs in surgery rooms has been due to both equipment issues and administrative resistance to take on additional costs. SEDs have been described as cumbersome,

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[6] Dermatological Surgery, November 2021, *Optimizing Parameters for Smoke Evacuation* https://journals.lww.com/dermatologicsurgery/abstract/2021/11000/optimizing_parameters_for_smoke_evacuation.7.aspx

[7] CDC, June 2014, *Control of Smoke From Laser/Electric Surgical Procedures*, https://www.cdc.gov/niosh/docs/hazardcontrol/hc11.html

[8] Science Direct, September 2023, *Surgical smoke: A hidden killer in the operating room*, https://www.sciencedirect.com/science/article/pii/S1015958423003731#bib64

bulky, noisy, and potentially act as a distraction during surgery.[9] Additionally, the tubing for an SED needs to be replaced after each procedure to ensure aseptic use. Poorly constructed smoke pencils add weight to devices which led to wrist fatigue and vacuum noise. Newer versions of SEDs and LEVs have improved.

Legislation for Surgical Smoke Evacuation

The Association of periOperative Registered Nurses (AORN) is leading the effort to enact legislation to ensure all operating rooms are free of surgical smoke. AORN also has published comprehensive summaries on the dangers of surgical smoke.[10]

Rhode Island and Colorado were the first two states to legislate the evacuation of surgical smoke in 2019. A total of fifteen states have passed legislation to require the evacuation of surgical smoke. An additional seven states have pending legislation, as of February 2024, for surgical smoke evacuation.[11] A list of these states is in Appendix B. The roll out of enacting such legislation is typically done over a few years after legislation is signed.

Existing Solutions to Eliminate Surgical Smoke

Three large medical supply companies currently provide SED systems. Additionally, other medical device suppliers have LEV and/or SED systems. Each of these solutions utilize traditional HEPA medium to filter out harmful particulates. We focus on the product offerings of the three large healthcare device companies. All three offerings contain:

(a) a small pen device that is designed to be located close to the cutting site,
(b) a tubing system to transfer the surgical smoke, and
(c) a box that contains the vacuum, the filter and electronics controlling the system.

Due to the lack of price transparency in the medical supply market, we are only able to identify pricing for the Medtronic solution. For competitive reasons, we expect other offerings are at a similar price level.

Medtronic Solution
Product: RapidVac by ValleyLab
Cost = $7,500 – 8,600 new (includes 1 filter)
$1,000 – 2,000 refurbished
Filter = $1,489 for a replacement filter. A price of $1,025 was discovered from a discount distributor. Each filter lasts for 25 hours of usage.

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[9] The Clinical Services Journal, March 2022, *Surgical smoke inhalation: staff fear infection risk*, https://www.clinicalservicesjournal.com/story/38019/surgical-smoke-inhalation-staff-fear-infection-risk

[10] AORN Journal, January, 2021, *State of the Science: A Concept Analysis of Surgical Smoke*, https://www.aorn.org/docs/default-source/aorn/essentials/surgical-smoke/files/state-of-the-science.pdf?sfvrsn=53ee1efd_0

[11] AORN, February 2024, *National Map of Current Surgical Smoke Evacuation Laws and Legislation*, https://www.aorn.org/get-involved/government-affairs/policy-agenda/surgical-smoke-free-or/smoke-bills

Stryker Solution
Product: Neptune SafeAir
No pricing information

J&J Solution
Product: Megadyne
No pricing information available
Megadyne does product feature comparisons with Stryker and Medtronic offerings.

Use of Surgical Masks

Standard surgical masks, which filter out particles larger than 5 microns, are inadequate in protecting surgeons and operating room personnel from surgical smoke. Many particles such as pathogens and VOCs are smaller than 5 microns. N95 masks can play a role since they filter out particles down to 0.075 microns +/- 0.02 microns. Surgical smoke from electrocautery averages 0.07 microns. Problems arise if solely rely on N95 masks from the gap between the mask and face. If medical personnel can feel exhaled air coming out of the gap between the mask and the face, then the mask is not being properly worn.

Filtration in Smoke Evacuation Devices

SEDs use high-efficiency particulate air (HEPA) medium, and some have ultralow particulate air (ULPA) filters. The standard for HEPA medium is removal of 99.7% of particles down to 0.3 microns. ULPA filters remove at least 99.99% of particles down to 0.12 microns.

Electrosurgical creates particulates in the range of 0.07 – 0.42 microns. Lasers produce particulates from 0.35 – 6.5 microns. Ultrasonic scalpels produce particulates from 0.1 – 0.8 microns.[12] Other studies report the mean aerodynamic particulate size from electrocautery is 0.07 microns, and from laser tissue ablation, it is 0.31 microns. [13]

The PHILTER™ Solution

PHILTER™ MAAP technology eliminates harmful airborne particulate matter with a very small footprint and minimal power requirements. There are several different form factors of the MAAP technology that can work in medical surgery.

- MAAP technology can be integrated into the laser knife to eliminate any effluent smoke stream. This design eliminates harmful surgical smoke closest to the source.

[12] Science Direct, *Surgical smoke: A hidden killer in the operating room*, September, 2023, https://www.sciencedirect.com/science/article/pii/S1015958423003731
[13] NIH, June, 2019, *Awareness of surgical smoke hazards and enhancement of surgical smoke prevention among the gynecologists*, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6584931/

- In laparoscopic procedures, a MAAP device can be integrated into the portable system that pulls effluents out of the abdominal cavity.
- MAAP can be integrated into existing configurations of SED solutions.

Given the small real estate required for MAAP technology to effectively eliminate particulate matter, either of these three can be effective in eliminating SS. Providing multiple solutions enables surgeons and healthcare providers to select which is best for each procedure. Since the MAAP technology effectively ionizes particulate matter, it has a high efficacy over a number of uses compared to traditional filtration media used in current SEDs.

Market Approach – Integrate PHILTER™ Technology into Existing SED systems

- Develop a working prototype of the filtration component for an SED, similar in size to that used by each of the three suppliers.
- Test in house for life of MAAP technology filter designed for SED
- Demonstrate economic advantages of using MAAP in SED
    - Greater efficacy
    - Longer product life
    - Attractive margins
- Discuss with each of the suppliers our approach to micro-filtration.
- Licensing – Two Paths
    - Seek to work with one or more SED suppliers to integrate MAAP into their solution – this may be an exclusive and may require funding from the medical supplier.
    - Develop the MAAP technology on our own for this application and license to all three.

Market Approach – Create a Small SED system

- Develop a prototype of a pen that has the MAAP technology integrated into it.
- This is designed to work with the laser, electrocautery or placed next to it.
- May be most applicable for use in ASC settings along with a variety of cosmetic surgeries.

Market Size

The market for laser surgical knives is $4.9 billion worldwide in 2023 and expected to grow at a 14% CAGR to $18.7 billion in 2032.[14] The US market was reported at $1.89 billion in 2022 and forecasted to grow at a 12% CAGR through 2030.[15] The US represents 43% of the global market for lasers.

Market drivers for this strong growth include:

- Rising demand for minimally invasive surgeries

[14] Global Market Insights, March 2023, *Medical Laser Market*, https://www.gminsights.com/industry-analysis/medical-laser-market
[15] Fortune Business Insights, December 2023, *US Medical Lasers Market Size*, https://www.fortunebusinessinsights.com/u-s-medical-lasers-market-108760

- Technological advancements in medical laser systems
- Increasing demand for aesthetic treatments
- Growing medical tourism in developing countries

End use locations include hospitals, specialty clinics, and ambulatory surgical centers. Hospitals account for the largest share of the laser market at 32%.

One area of growth is driven by the introduction of technologically advanced laser knives that caters to the demand for cosmetic treatments including skin rejuvenation, hair removal and body sculpting. The Aesthetic Society reports over 9.2 million aesthetic procedures in the US during 2022, up 13.9% from 2021.

The medical laser market can be segmented into surgical lasers, aesthetic lasers, dental lasers, and other. The surgical laser market holds the largest market share of these. Growth in the surgical laser market is driven by the increased prevalence of acute and chronic diseases such as cancer, eye disorders and growing demand for minimally invasive surgeries. Additionally, lasers offer greater patient comfort. Two leading medical surgery applications include cancer cases and coronary artery disease, both are growing in North America with the aging populations.

Calculations of US Market Size for Addressing Surgical Smoke

In the US, there are 35,682 operating rooms in hospitals.[16] Definitive Healthcare reports 9,100 active ambulatory surgical centers (ASC) with an average of three operating rooms per ASC.[17] This equates to a total of 27,300 ASC operating rooms in the US. The total number of operating rooms in the US is 63,162.

Pricing data for SEDs indicates the following:

1. An initial system cost of $7,500 to $8,600. Refurbished equipment costs $1,000 to $2,000.
2. Replacement filters last for 25 hours of use
3. Discount price for filter = $1,025. Standard price = $1,489.

We focus on only the filter component in this analysis since this is what the MAAP technology developed by PHILTER™ will address. We use both the lowest and the standard cost quote in our calculations.

Assumptions and Calculations of US Market Size for Addressing SS

1. Focusing on hospitals, the average filter use time is three hours/surgery day. This is conservative given how surgery rooms are booked in hospitals.
2. Surgeries are only done five days a week, for an average of 20 days/month. There are a total of 240 days of surgery each year in a hospital surgery room.
3. Filters last 8.3 surgical days. (25 hrs use/3 hrs use per day).

[16] Definitive Healthcare, April 2023, https://www.definitivehc.com/resources/healthcare-insights/number-of-us-operating-rooms#:~:text=In%20total%2C%20there%20are%2035%2C870%20operating%20rooms%20across,with%20an%20average%20of%20six%20ORs%20per%20hospital

[17] Definitive Healthcare, 2024, https://www.definitivehc.com/blog/how-many-ascs-are-in-the-us

4. The number of filters used per hospital surgery room per year = 28.8 (240 days /8.3 days per filter).
5. Hospital surgical market using discounted filter price = $1.05 billion annually (# of surgical rooms*filters/yr*discount price). Using the standard price, the hospital surgical market = $1.53 billion annually.
6. We perform the same analysis for the ambulatory surgery centers, assuming a lower use rate of an average of 2 hours per day per operating room.
7. The ASC market using discounted filter price = $538 million annually. Using the standard filter price, the ASC market size = $780 million annually.
8. The total US market for replacement filters for hospitals and ASC operating rooms is $1.59 billion annually using the discounted price and is $2.31 billion annually using the standard price.

Using the laser market as a proxy, where the US represents 43% of the worldwide market for laser tools, we calculate the worldwide surgical smoke replacement filter market of $3.7 billion annually using the discounted price point, and $5.37 billion using the standard price point.

US & Global Market Size for SS Filters

($bil)

	Filter Price Point	
	Discounted	Standard
US Hospital Surgical	$1,053	$1,530
US Ambulatory Surgery Centers	$537	$780
Total US Market ($bil)	**$1,591**	**$2,311**
Estimated Global Market ($bil)	**$3,699**	**$5,374**

Takeaways

1. The parameters for PHILTER™ MAAP technology to replace existing SED filters using HEPA and ULPA are clear. Efficacy for filtration, a longer life compared to HEPA and ULPA filters, and at a reasonable cost. This is achievable based on efficacy of MAAP in the lab.
2. In addition to the three large medical suppliers noted, we expect additional competitive products will be introduced to address SS, driven by the legislative rollout at the state level.
3. All SEDs and LEVs require filters. PHILTER™ MAPP technology is unique in its ability to filter very small particulate matter without the use of traditional filtration medium. Traditional filtration media clogs and requires replacement in a relatively short period of time.
4. Addressing surgical smoke is a growing worldwide health issue with the growth in the use of lasers and electrosurgical tools.

Summary

The harmful impact of surgical smoke is well documented. Adoption of SEDs and LEVs in the past few decades has been less than adequate for a variety of reasons. Now that 15 states have enacted legislation to require smoke evacuation systems for surgical smoke, and another 7 states have legislation pending, we anticipate more widespread placement of surgical smoke evacuation systems in the next several years.

All SEDs and LEVs require the use of a filter to eliminate the harmful particulates in surgical smoke, which leads to recurring purchases from surgical facilities. The US market for replacement filters is estimated at $1.05 – 1.53 billion for hospitals alone. When including ambulatory surgical centers, the US market is $1.6 – 2.3 billion annually. The worldwide addressable market is estimated at $3.7 - $5.4 billion annually. The range for the addressable market is based on standard versus discounted pricing of replacement filters.

PHILTER™ has technology to eliminate harmful particulates without traditional filter medium, MAAP, which is well positioned to replace the filters in any SED or LEV product designed for surgical smoke. Efficacy, filter life, and pricing parameters define the minimum requirements for MAAP technology to meet the needs of the surgical smoke market. Based on lab performance of MAAP technology in a much smaller footprint compared to what would integrate into existing SEDs, such performance parameters should be readily met.

Appendix A

Surgical Smoke Generated by Different Surgical Devices

The harmful particulates inherent in surgical smoke have been well documented in a number of studies cited in the report. This list identifies the harmful contaminants in surgical smoke resulting from the use of different surgical tools.

From Electrosurgical Scalpels

Viable Cells
Melanoma Cells

Virus
Human coronavirus RNA, Human Papillomavirus (HPV)

Bacteria
Serratia marcescens, Hafnia alvei, Serratia liquefaciens, E. Coli, Aeromonas sobria, Lactococcus garvieae, Citrobter braakii, Citrobacter freundii, Raoultella planticola

Organic Chemicals
Acetylene, Hydrogen Cyanide, 1,3-butadiene, Benzene, Toluene, Furfural, Styrene, Ethylbenzene, 1-decene, Heptene, Methylpropene

From Lasers

Virus
Human Papillomavirus (HPV), Murine Papillomavirus, HIV proviral DNA

Organic Chemicals
Benzene, formaldehyde, Acrolein, Polycyclic aromatic hydrocarbons

From Ultrasonic Scalpels

Virus
Human coronavirus RNA

Organic Chemicals
Benzene, Ethylbenzene, Styrene, Toluene, Heptene, Methylpropene

From LEEP (Loop electrosurgical excision procedure)

Virus
Human Papillomavirus (HPV)

Organic Chemicals

Benzene, Toluene, Xylene, Ethylbenzene, Styrene, Butyl acetate, Acrylonitrile, 1,2-cichloroethane, Phenol, Chlorine, Cyanide, Hydrogen cyanide, Carbon monoxide

References

1. Science Direct, *Surgical Smoke: A hidden killer in the operating room*, September, 2023, https://www.sciencedirect.com/science/article/pii/S1015958423003731
2. Science Direct, *A Systematic review of the harmful effects of surgical smoke inhalation on operating room personnel*, March 2023, https://www.sciencedirect.com/science/article/pii/S277263202300003X
3. CDC, *Surgical Smoke Inhalation: Dangerous Consequences for the Surgical Team*, June 2020, https://blogs.cdc.gov/niosh-science-blog/2020/06/18/surgical-smoke/

Appendix B

States with Surgical Smoke Legislation

Enacted Legislation

Washington
Oregon
California
Arizona
Colorado
Missouri
Illinois
Ohio
Kentucky
New York
New Jersey
Connecticut
Rhode Island
Georgia
Louisiana

Pending Legislation

Minnesota
Pennsylvania
Massachusetts
Virginia
W. Virginia
N. Carolina
Florida

Appendix C

Current Products for Surgical Smoke

Medtronic - RapidVac™ by ValleyLab

Controller with filter

ULPA Replacement filter

Stryker – Neptune SafeAir

J&J – Megadyne