

BACKGROUND

Liu et al., estimate 500K staff are exposed to surgical smoke in the United States yearly (2019). Smoke plume is a harmful by-product from heat generating devices that is carcinogenic, mutagenic, and teratogenic (Roger, 2021).

An estimated 150+ harmful pollutants are in surgical smoke exposing patients and staff to blood fragments, viruses, pathogens, and forever chemicals (Kahramansoy, 2024; S.T.O.P. Carcinogens at Work, 2025). The average surgical smoke produced in one operating room per day is approximately the equivalent of exposure to 30 cigarettes. Health issues for patients are often immediate and issues for staff are seen after long-term exposure.

Figure 1.
Illustration of different categories of surgical smoke contaminants.

Components of Surgical Smoke			
VOCs			Pathogens
1, 3-butadiene	ethylbenzene	alcohol and derivatives	HPV
acetonitrile	formaldehyde	xylene and derivatives	HIV
acrolein	furfural	aldehydes and derivatives	SARS-COV-2
allyl cyanide	methanol	chloroform	HBV
benzene	propane	carbon tetrachloride	Serratia Marcescens
benzaldehyde	acetone	vinyl chloride	
cyclohexanone	acetaldehyde	phenol	
crotonaldehyde	styrene	toluene	
PAHs			Chemicals
acenaphthene	fluorene	chrysene	ammonia
acenaphthylene	naphthalene	fluoranthene	carbon monoxide
anthracene	pyrene	benzo(a)fluoranthene	hydrogen cyanide
			hydrogen sulfide

Source: Data compiled by author from Benaim et al., 2024.

PURPOSE

The aim was increasing staff knowledge of the harmful effects of surgical smoke and improving compliance with evacuation measures. At UMC, surgical smoke evacuation tools are available for use in trauma and the main operating rooms but adoption is low. Showcasing this project models how it can be successful at UMC.

REFERENCES

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BEST PRACTICES

Surgical smoke plume is hazardous with no safe level of exposure. A combination approach for removing surgical smoke is recommended:

- Portable smoke evacuation machines - gold standard
- Room exhaust systems - not sufficient alone
- Room suction - with ultra-low penetration air (ULPA) filter
- High filtration masks – required for high-risk cases (AORN, 2026; NIOSH, 1999; NFPA, 2024; ANSI, 2024; OSHA, n.d.).

Figure 2.
Suction sleeve for smoke evacuation electrocautery pencil.



Note. Photograph taken by author, 21 Jul 2025.

Figure 3.
Smoke evacuation electrocautery pencil.



Note. Photograph taken by author, 21 Jul 2025.

Figure 4.
Smoke evacuation device with ULPA filter and port with tubing connected.



Note. Photograph taken by author, 21 Jul 2025.

Figure 5.
Smoke evacuation device settings displayed.



Note. Photograph taken by author, 21 Jul 2025.

PROCESS IMPROVEMENT

At a local Las Vegas military facility, a gap analysis and surgical smoke evacuation policy revision occurred to set the stage for the project. Next, an action plan to improve compliance by identifying champions, setting key dates for implementation phases, identifying competencies for staff, creating an education and training schedule, and selecting a method to monitor project performance.

A 3-month audit reviewed electronic healthcare records for use of surgical smoke evacuation measures. The audit consisted of 754 patient charts which yielded an increase from 13% to 96% compliance- earning the Association of periOperative Registered Nurses (AORN) 'Go Clear' Award recertification in 2026. The 'Go Clear' award is a national recognition highlighting the commitment to being a center of excellence in surgical safety which serves as a roadmap for other facilities to implement.

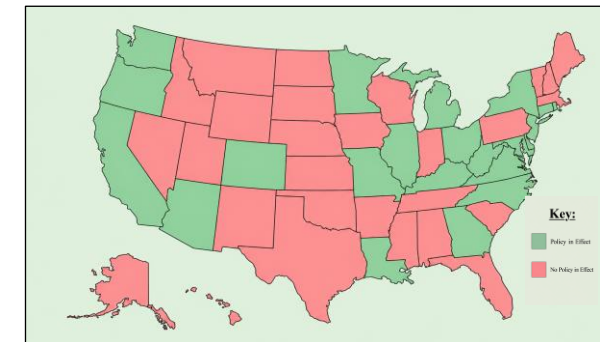
CONCLUSIONS

Prevention of surgical smoke is unavoidable, but the ability to minimize exposure is widely available. A combination approach safeguards patients and staff. The surgical smoke project could be mirrored at UMC to uphold the highest industry standards in patient safety and occupational health.

FUTURE DIRECTIONS

- **Local Level** – Advocate to key facility stakeholders at UMC. Create a working group for smoke evacuation. Develop a policy for smoke evacuation. Implement an education and training plan for competency verification and quality assurance with AORN's 'Go Clear' program to become a nationally recognized smoke-free facility.
- **State/National Level** – Currently, 22 States have mandatory smoke evacuation legislation (AORN, 2025). Advocate to Nevada Legislature representatives, urging officials for a surgical smoke evacuation mandate.

Figure 6.
Surgical smoke evacuation legislation mandates across the United States as of July 2026.



Note. Image generated by author using ChatGPT on 27 Jul 2026.