



EDUCATIONAL RESOURCES

Sustainability Without Sacrificing Safety: Smart Anesthesia Practices for ASCs

Sherry Bernardo, DNP, MHA, CRNA
American Association of Nurse Anesthesiology

 AMBULATORY SURGERY CENTER



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Learning Objectives

- Describe environmental and occupational impact of WAG and GWP volatile agents in the ASC setting
- Identify evidence-based strategies to reduce anesthetic-related emissions, including low FGF techniques and alternative anesthetic approaches
- Implement practice waste reduction, recycling, and pharmaceutical disposal practices to decrease the ASC carbon footprint
- Evaluate facility-level opportunities to improve OR efficiency, energy conservation, and sustainable supply chain decisions

Environmental Impact of Anesthesia

- Healthcare = major contributor to greenhouse gas (GHG) emissions
- OR = largest source of hospital waste and emissions
- Anesthesia contributes via:
 - Volatile anesthetic gases
 - Single-use plastics
 - Energy-intensive practices

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Waste Anesthetic Gases (WAG)

- Released during anesthesia delivery (e.g., N₂O, sevoflurane, desflurane)
- Enter atmosphere unchanged
- Contribute to:
 - Climate change
 - Air pollution
- Also create occupational exposure risks

Occupational Risks of WAG Exposure

Acute: health effects that typically manifest soon after exposure, impacting immediate well-being.

- Headaches
- Irritability
- Fatigue
- Nausea
- Drowsiness
- Dizziness
- Impairments in judgment, coordination, and cognitive performance

Chronic: health effects that may develop over prolonged or repeated exposure periods, are more severe, and can have lasting implications.

- Neurological, liver, and kidney disease
- Reduced brain efficiency
- Irritation of the respiratory tract
- Cancer
- Reproductive health concerns
- Miscarriages
- Infertility in both males and females
- Increased risk of birth defects

Asfaw SH, Galway U, Hata T, Moyle J, Gordon IO. Surgery, anesthesia, and pathology: A practical primer on greening the delivery of surgical care. *The Journal of Climate Change and Health*. 2021;4:doi:10.1016/j.jocl.2021.100076
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High Global Warming Potential (GWP) Agents

Agent	GWP (20/100 yr)	Atmospheric Lifetime	Ozone Depletion	Environmental Impact Notes
Desflurane	7,020 / 2590	14.1 years	No	Most potent volatile GHG
N ₂ O	273 / 273	109 years	Yes	Ozone depleting potential
Sevoflurane	702 / 195	1.9 years	No	Lower GWP, shorter atmospheric lifetime
Isoflurane	1,930 / 539	3.5 years	Yes	Moderate GWP; ozone depleting potential

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Climate Change Vulnerabilities

- Seasonal changes contributing to flood and drought
- Reduced agricultural productivity contributing to food insecurity
- Ecosystem changes contributing to infectious diseases
- Air pollution and aeroallergens contributing to cardiorespiratory disease

Reducing Anesthetic Emissions

- Choose lower GWP agents when appropriate
- Avoid or minimize the use of:
 - Desflurane
 - Nitrous Oxide (N₂O)
- Incorporate sustainability into formulary decisions

Optimize Fresh Gas Flow (FGF)

- Target ≤ 1 L/min during maintenance
- High flows = major source of emissions
- Low-flow anesthesia:
 - Safe
 - Significantly reduces waste

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Alternative Anesthesia Techniques

- Total Intravenous Anesthesia (TIVA)
- Regional anesthesia

- Benefits:
 - Reduced GHG emissions
 - Less postoperative nausea and vomiting (PONV)
 - Faster recovery, improved outcomes

Reduce WAG Exposure in Practice

- Use effective scavenging systems
- Perform routine leak testing
- Ensure proper ventilation
- Monitor gas levels regularly

Waste in the OR

- OR = 21-33% of hospital waste
- Anesthesia = ~25% of OR waste
- Major contributors:
 - Plastics
 - Packaging
 - Pharmaceuticals

Xiao MZX, Abbass SAA, Bahrey L, Rubinstein E, Chan VWS. A Roadmap for Environmental Sustainability of Plastic Use in Anesthesia and the Perioperative Arena. *Anesthesiology*. 2021;135(4)doi:10.1097/ALN.0000000000003845
Shoham MA, Baker NM, Peterson ME, Fox P. The environmental impact of surgery: A systematic review. *Surgery*. Sep 2022;172(3):897-905. doi:10.1016/j.surg.2022.04.010

Reduce Single-Use Waste

- Use reusable equipment when safe
- Open supplies only when needed
- Favor multi-use devices (e.g., circuits, probes)
- Apply “reduce, reuse, recycle” principles

Recycling & Reprocessing

- Up to ~60% of anesthesia waste is recyclable
- Focus on:
 - Plastic wrappers
 - IV tubing, syringes
- Reprocessing reduces:
 - Cost
 - Carbon footprint

American Society of Anesthesiologists Committee on Environmental Health. Greening the Operating Room and Perioperative Arena: Environmental Sustainability in Anesthesia Practice. 2024. <https://www.asahq.org/about-asa/governance-and-committees/asa-committees/environmental-sustainability/greening-the-operating-room>

Pharmaceutical Waste Management

- Improper disposal contaminates water systems
- Key strategies:
 - Use correct disposal bins
 - Reduce over-preparation of drugs
 - Consider prefilled syringes
- Propofol = major contributor

Proper Sharps Disposal

- Only true sharps in sharps container
- Misclassifications increases:
 - Cost
 - Environmental harm (incineration)
- Education is key to improvement

Energy Use in the OR

- HVAC = largest energy driver
- Air exchange, temperature, humidity = major contributors
- ORs are highly energy-intensive environments

Energy Conservation Strategies

- Reduce air exchanges when OR not in use
- Turn off anesthesia machines when idle
- Use LED lighting and motion sensors
- Optimize equipment processing

Sustainable Facility Practices

- Implement recycling programs
- Optimize procedure kits (reduce unused items)
- Consider lifecycle cost of supplies
- Use reprocessing and green vendors

Technology & Innovation

- WAG capture systems (up to 99% recovery)
- Gas destruction technologies
- Smart OR design (LEED principles)
- Data tracking (provider report cards)

Meyer MJ. Desflurane Should Des-appear: Global and Financial Rationale. *Anesthesia & Analgesia*. 2020;131(4)doi:10.1213/ANE.00000000000005102

Building a Culture of Sustainability

- Education and training
- Interdisciplinary collaboration
- Leadership engagement
- Continuous quality improvement

For **additional information**, please refer to
the full AANA *Environmental
Stewardship in Anesthesia Care*
document:



Questions?





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Thank you!

Contact information:
practice@aana.com



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