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Decarbonizing Surgeries: Anesthetic Gas Mitigation Strategies

Dr. William A. Anderson
Professor Emeritus, Department of Chemical Engineering,
University of Waterloo,
Waterloo, Ontario, Canada

The anesthetic gases used in major surgery such as Sevoflurane and Isoflurane (collectively known as "fluranes") are chemically similar to some now-banned fluorocarbon refrigerants and likewise have strong global warming potentials. These fluranes are also PFAS compounds (per- and polyfluorinated alkyl substances, or "forever chemicals") according to some definitions. In addition, some hospitals use nitrous oxide (N_2O) either separately or together with the fluranes and this emission adds to the global warming emissions as well as the ozone depletion impacts.

The waste anesthetic gases created during surgery are often collected by an anesthetic gas scavenging system (AGSS) and discharged directly to the environment at each hospital. Surgeries in Canada, the U.S. and the U.K. combined have been estimated to contribute 9.7 million tonnes of carbon dioxide equivalent emissions per year. The anesthetics emissions are potentially responsible for 50% of an operating room's carbon footprint. Therefore, these emissions are a small but significant contribution to greenhouse gas emissions, that could be readily mitigated from the known number of major hospitals in urban areas across North America, Europe, and elsewhere.

This presentation will review the key environmental chemistry of the various common anesthetic gases, as well as the details of their use in operating theatres and the AGSS. Suggested mitigation strategies based on elimination and substitution will be discussed, as well as the currently available emission control approaches using adsorption or destruction. The limitations of emission controls will be highlighted, due to the highly dynamic nature of the emissions, the very different chemical natures of the fluranes and N_2O, and the need to create a significant net CO_2 equivalent reduction taking into account all the material and energy inputs to the control system. Future opportunities and directions will be discussed for continued progress in addressing this particular environmental impact.