RSNA Press Release

Radiologists Propose Actions to Combat Climate Change

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OAK BROOK, Ill. — A diverse writing group—lead by authors at the University of Toronto—have developed an approach for radiology departments and practices to reduce their greenhouse gas emissions and become more resilient to the effects of climate change. They outlined their action plan in a Radiology in Focus article, published today in *Radiology*, a journal of the Radiological Society of North America (RSNA).

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Kate Hanneman, M.D., M.P.H.

"Rising greenhouse gas emission levels lead to climate change, extreme weather events and worsening air pollution with downstream adverse health effects," said lead author Kate Hanneman, M.D., M.P.H., vice chair of research and associate professor at the University of Toronto and deputy lead of sustainability at the Joint Department of Medical Imaging, Toronto General Hospital. "The goal of this article is to increase awareness of the interconnected relationship between planetary health and radiology, emphasize why radiologists should care about sustainability, showcase actions that can be implemented to mitigate our impact and prepare departments to adapt to the effects of climate change."

Burning fossil fuels and other human activities that increase atmospheric greenhouse gas levels are the primary drivers of climate change. Radiology, through the production and use of medical imaging equipment and related supplies, is estimated to generate up to one percent of overall emissions.

"We propose a coordinated approach and concrete actions radiologists can implement to help sustain the health of the planet and, in turn, improve the health of their communities and patients," Dr. Hanneman said.

The authors suggest radiology departments begin by establishing a sustainability team and dashboard to track and measure key metrics and performance indicators.

"Departments should build a diverse team that includes all key stakeholders, including radiologists, technologists, leadership, IT and facilities management," she said. "The individuals and groups impacted by policies and protocol changes should be part of the conversation from the beginning."

Recommended high-impact interventions to improve sustainability in radiology include transitioning from disposable to reusable medical supplies, turning off climate-control systems in unoccupied areas and powering down equipment when not in use.

Dr. Hanneman said that by switching scanners off or to lower power states when not in use, overall greenhouse gas emissions can be reduced by up to 33% for MRI and between 40% and 80% for CT. Optimizing scanner scheduling can also reduce idle time and reduce the average greenhouse gas emissions per exam for MRI and CT units.

"Utilizing one CT scanner 24/7 with minimal idle time is more efficient than utilizing three scanners from nine to five," she said.

Another potential action is to implement decision-support tools to choose lower-energy imaging tests when appropriate. Carbon dioxide equivalent, or CO2e emissions, vary by imaging modality and are higher for MRI and CT compared to ultrasound and X-rays.

"When more than one imaging test is appropriate to answer a clinical question, imaging tests with lower emissions can be prioritized," Dr. Hanneman said.

The authors also suggest abbreviating imaging protocols and expanding the use of clinical low-field MRI applications.

"Expanding clinical low-field MRI application will not only decrease use-phase emissions, but it can also potentially improve global access to MRI," she said. "Low-field MRI units tend to be smaller and less expensive, and there's growing recognition they can help address health inequities."

The authors also recommend working with manufacturers to update or refurbish equipment rather than purchasing new imaging equipment, when feasible. To reduce packaging waste, the authors suggest switching from single dose to multi-patient contrast injection systems and to establish sustainable waste management programs.

"The familiar concepts of reducing, re-using and recycling can be applied within radiology," she said.

Dr. Hanneman said the team's recommendations are not intended to be one-size-fits-all.

"Not all of the suggested actions will be applicable or feasible to implement in every radiology department," she said. "Sustainability teams will need to think creatively to determine what actions will have the greatest impact in their department."

The article was part of a special sustainability-themed issue of *Radiology* in honor of Earth Day. Two other sustainability-themed articles were published today. The first, "Energy and Greenhouse Gas Emission Savings Associated with Implementation of an Abbreviated Cardiac MRI Protocol" demonstrates ways to adjust MRI practices to reduce greenhouse gas emissions. The second article, "Contrast Media Driven Anthropogenic Gadolinium: Knowns and Unknowns" discusses how MRI contrast agents have been introduced into the environment and documented in water systems.

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"Planetary Health and Radiology: Why We Should Care and What We Can Do." Collaborating with Dr. Hanneman were Hayley McKee, B.Sc., M.D(C)., Maura J. Brown, M.D., M.H.A., Helen H. R. Kim, M.D., Florence X. Doo, M.D., M.A., Hayley Panet, M.H.Sc., C.H.E., M.R.T(MR)., Andrea G. Rockall, M.R.C.P., F.R.C.R., and Reed A. Omary, M.D., M.S.

"Energy and Greenhouse Gas Emission Savings Associated with Implementation of an Abbreviated Cardiac MRI Protocol." Fadi Ibrahim, M.D., Farah Cadour, M.D., M.S., Adrienne Campbell Washburn, Ph.D., Bradley D. Allen, M.D., M.S., Jan Vosshenrich, M.D., Maura Brown, M.D., Paaladinesh Thavendiranathan, M.D., S.M., Kate Hanneman, M.D., M.P.H.

"Contrast Media Driven Anthropogenic Gadolinium: Knowns and Unknowns." Robert E. Lenkinski, Ph.D., Neil M. Rofsky, M.D., M.H.A.

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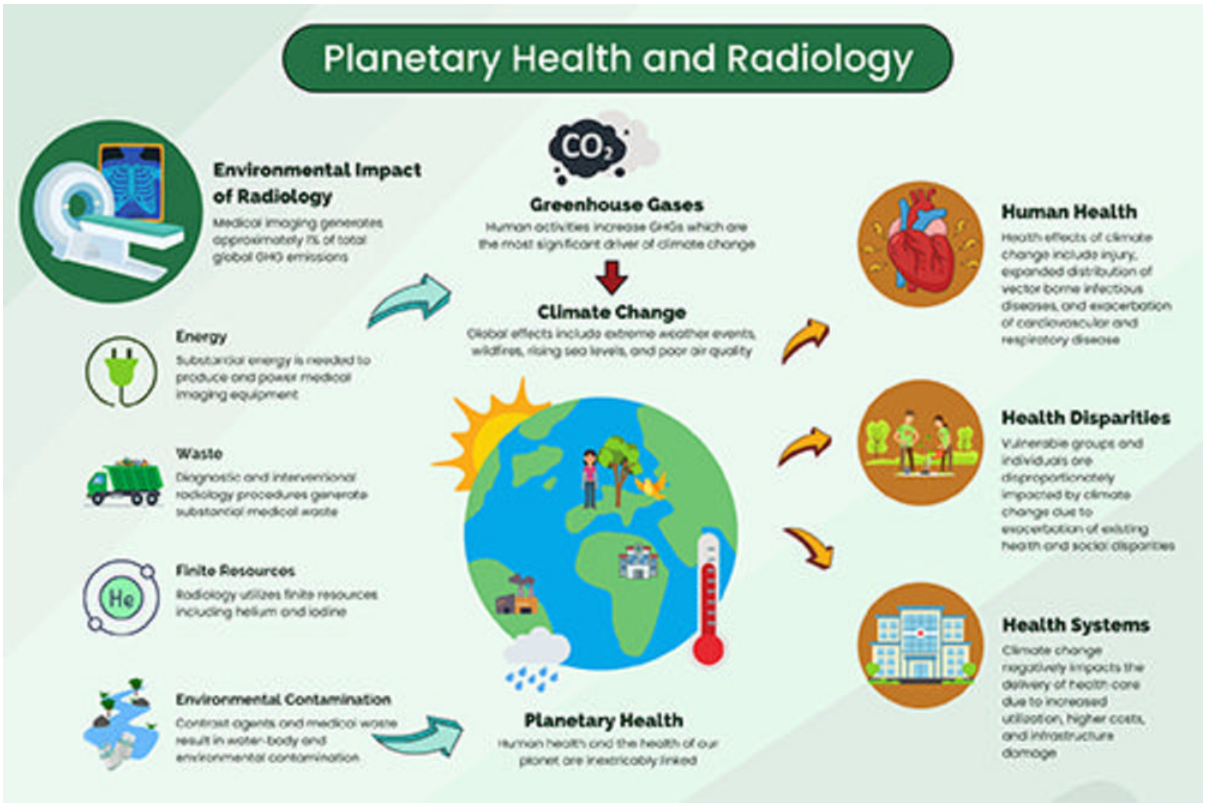


Figure 1. Diagram shows interrelationship of planetary health, climate change, and radiology. GHG = greenhouse gas.
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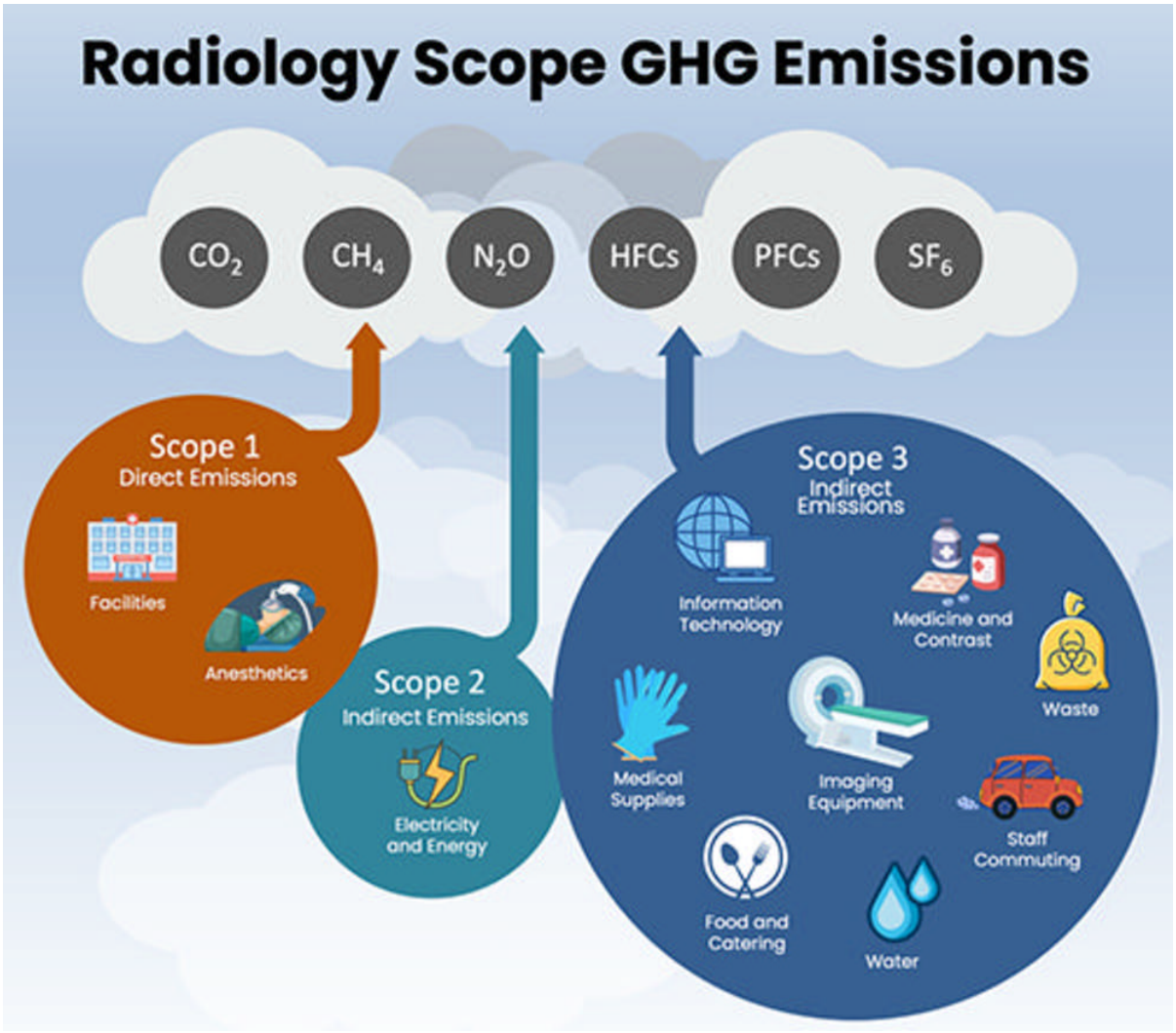


Figure 2. Diagram of Greenhouse Gas Protocol emissions in radiology by scope. Scope 1 encompasses direct greenhouse gas (GHG) emissions on site from sources owned or controlled by the organization, such as emissions generated in an imaging department through the use of inhalational anesthetics or the burning of fossil fuels for building heating. Scope 2 encompasses indirect upstream emissions from the generation of purchased electricity. Scope 3 includes all other upstream and downstream indirect emissions, such as those that occur in producing and transporting goods and services. Upstream emissions relate to the production of products (such as the production of imaging equipment). Downstream emissions relate to the use of products and services and disposal of products (such as disposal of contrast agent waste). HFC = hydrofluorocarbon, PFC = perfluorocarbon.
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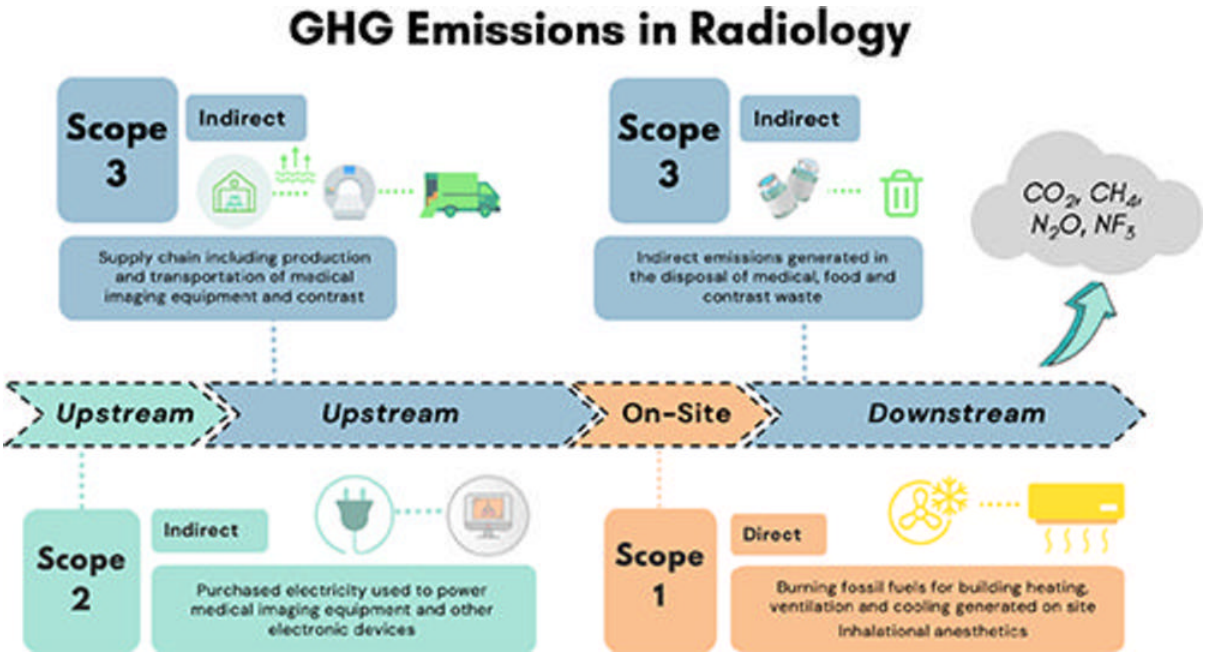


Figure 3. Diagram shows overview of greenhouse gas (GHG) emissions in radiology by Greenhouse Gas Protocol scope in relation to upstream, on-site, and downstream activities. Upstream emissions relate to the production of products (such as imaging equipment). On-site emissions include GHG emissions generated in an imaging department (such as through use of inhalational anesthetics or burning of fossil fuels for building heating). Downstream emissions relate to the use of products and services and disposal of products (such as disposal of contrast agent waste).
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Figure 4. Diagram shows summary of mitigation and adaptation strategies in radiology. GHG = greenhouse gas, IT = information technology.
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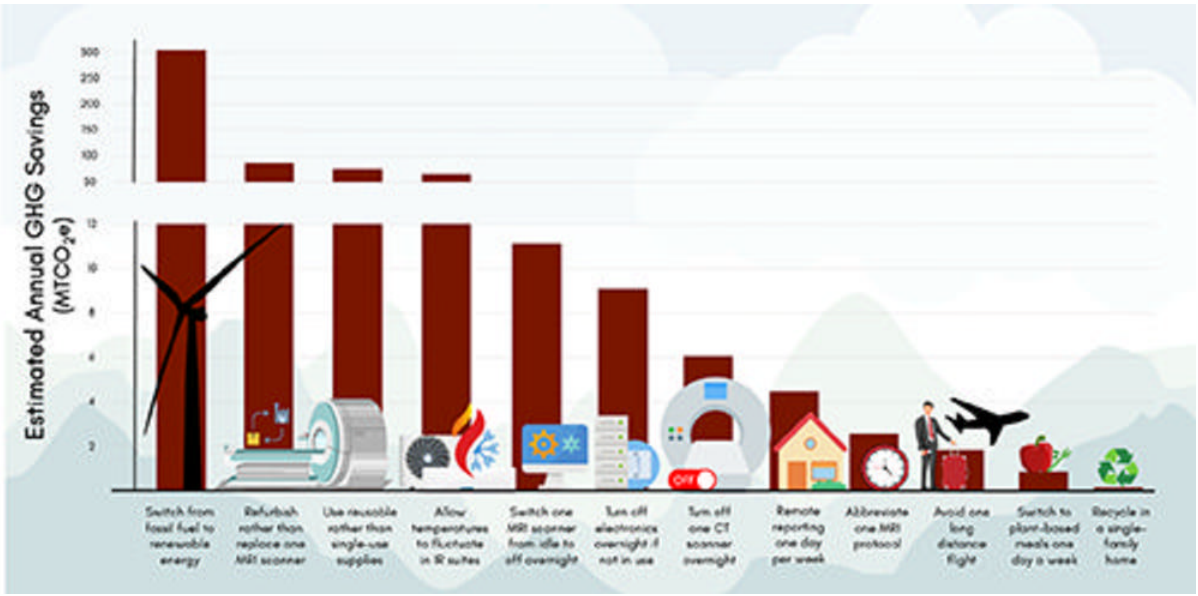


Figure 5. Graph of actions to reduce greenhouse gas (GHG) emissions in descending order of annual GHG emission savings. Estimates related to long-distance flights, plant-based meals, and recycling reflect personal choices and are included for perspective, to put the radiology-specific estimates in context. All other emission estimates relate to medical imaging departments. IR = interventional radiology, MTCO2e = metric tons of carbon dioxide equivalents.
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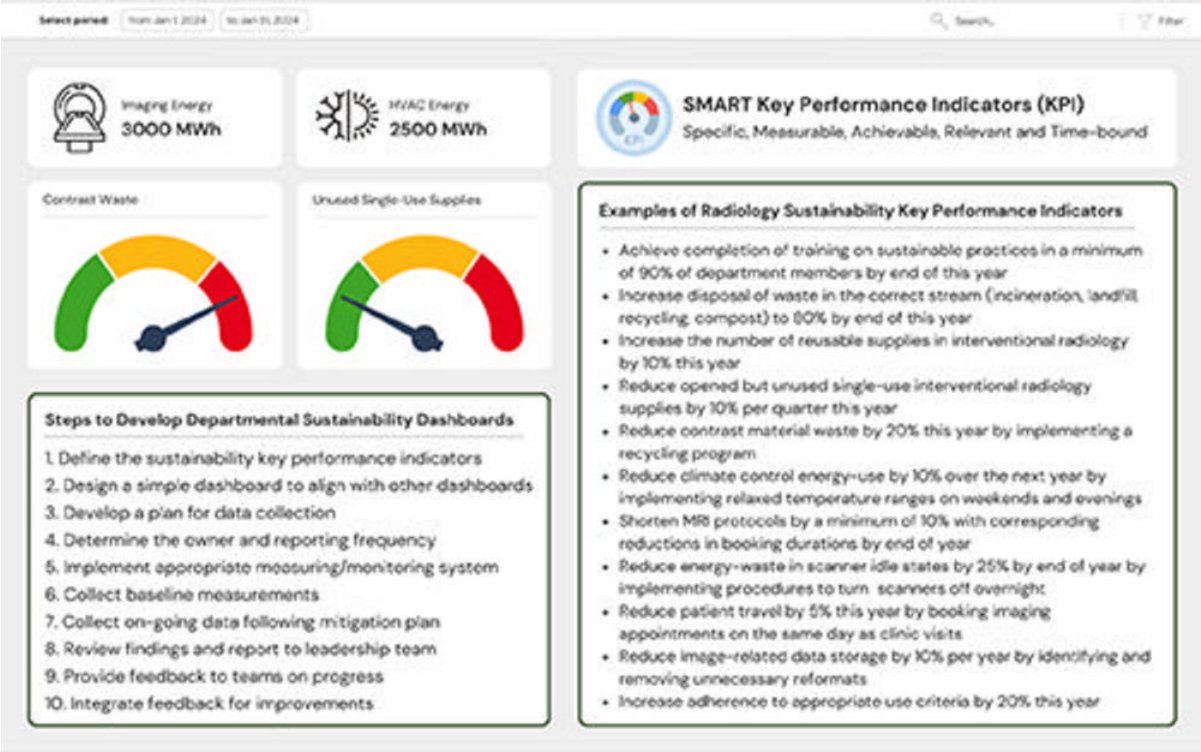


Figure 6. Diagram shows a model radiology sustainability dashboard (upper left), with a description of the steps to develop a departmental sustainability dashboard (lower left) and examples of sustainability key performance indicators relevant to radiology (right). This list of key performance indicators can be modified according to needs and local practices. The individual or team responsible for measurements will depend on what is being measured. For example, energy use might be measured by the medical physics team; data storage, by the informatics team; contrast agent usage and recycling, by a physician- or technologist-led team; and usage of disposable supplies, by the interventional radiology team. HVAC = heating, ventilation, and air conditioning.
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Figure 7. Diagram of key stakeholders for sustainable radiology. Partnership with key stakeholders is essential to improve sustainability in radiology.
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