Sulfur Hexafluoride: The Good, the Bad & the Future

Managing a Mission-critical Greenhouse Gas

SULFUR HEXAFLUORIDE (SF_6) is a gas used by the Navy in many tactical systems, from shipboard targeting radar to torpedo propulsion systems and underwater warfare acoustic countermeasures. Unfortunately, SF_6 is also a potent greenhouse gas (GHG) —more than 22,800 times more potent than carbon dioxide. Because SF_6 is non-flammable, nontoxic and a strong dielectric (providing excellent electrical insulation), it is a critical material in a host of Navy applications including the MK 50 torpedo, electric switchgear on shoreside power facilities, submarine countermeasures and mine hunting and in radar domes.

Clearly, proactive management and control of SF_6 emissions will be needed to sustain mission capability while complying with emerging GHG reduction policies and regulations. As the debate continues on how to best regulate GHGs, several key Department of Defense (DoD) offices collaborated to assess the risks related to DoD's use of SF_6 and identify risk management actions.

In November 2007, the Clean Air Act Services Steering Committee (CAASSC)—which addresses military issues relevant to the Clean Air Act (CAA)—and staff from the Office of the Secretary of Defense's (OSD) Emerging Contaminants Program discussed the possibility of conducting an assessment related to the evolving regulatory climate surrounding SF_6. The Emerging Contaminants Program, part of OSD's Chemical and Material Risk Management Directorate (CMRMD), identifies, assesses and takes steps to manage the impacts posed by emerging contaminants (EC) on major DoD functional areas before regulations take effect. The program uses a "scan-watch-action" process for "looking over the horizon" to identify and assess ECs. This collaborative assessment prompted the development of Risk Management Options (RMO) and a recommendation that SF_6 be elevated to CMRMD's high priority "Action List" for ECs.

The DoD's assessment found that 22 states had GHG emission targets. Most significantly, the California Air Resources Board has proposed a phase-out of all uses of SF_6 in 2013. In this instance, the CMRMD, Air Force and the DoD Regional Environmental Coordinator teamed up to secure an extension until 2020 for critical uses of SF_6 as a tracer gas to trace leaks in tanks and pipelines.

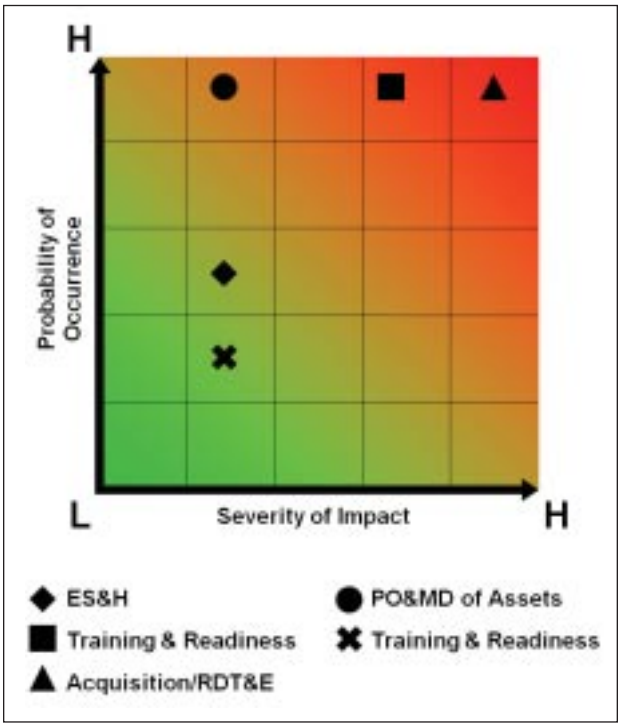
SF_6 is also monitored under the United Nations Framework for Climate Convention (UNFCC) and the Intergovernmental Panel on Climate Change. After the United States Supreme Court in April 2007 deter-

SF_6 in the Atmosphere

AVERAGE GLOBAL SF_6 concentrations increased by about seven percent per year during the 1980s and 1990s, mostly as the result of its use in the magnesium production industry, and by electrical utilities and electronics manufacturers. Given the low amounts of SF_6 released compared to carbon dioxide, its overall contribution to global warming is estimated to be less than 0.2 percent.

Torpedoes released from ships like the guided-missile frigate USS CROMMELIN (FFG 37) utilize SF_6 in their propulsion systems.
Mass Communication Specialist Seaman Adam Thomas

mined that GHGs are air pollutants under the CAA, the U.S. Environmental Protection Agency issued a proposed "endangerment" finding for GHGs under Section 202(a) of the CAA. These developments, in combination with a recent U.S. House of Representatives energy bill identifying SF_6 as a GHG, led to CMRMD's conclusion that restrictions, reductions in availability, higher costs and producer phase-outs are the likely results of potential GHG regulations. The graph below summarizes the first phase of the SF_6 assessment and displays which DoD functional areas are most likely to be affected by expected changes in the management of SF_6 risks.



Summary of impact assessment of SF_6 on DoD functional areas.

The potential risks and impacts to DoD functions were identified through the input of subject matter experts. On the graph shown below, high risks to DoD are in the upper right, while lower risks are located in the lower left. Possible SF_6 regulations (i.e., a proposed GHG regulatory scheme) would pose high risks to both Acquisition, Research, Development, Testing and Evaluation (Acquisition/RDT&E) and Training and Readiness. Regulation of SF_6 would pose little to moderate risk in other DoD functional areas, such as Production, Operations & Maintenance and Disposal (PO&MD), and Environment, Safety & Health (ES&H). The results of the assessment were so striking that SF_6 was elevated to the CMRMD's "Action List" and development of RMOs was accelerated. As a result of the assessment, some risk management actions were initiated immediately. For example, the Strategic Environmental Research and Development Program issued a Statement of Need for research on substitutes in November 2008.

Navy personnel launch a torpedo powered by SF_6 among other constituents.
Mass Communication Specialist Seaman Leah Allen

The assessment and draft RMOs were completed by CMRMD in June of 2009.

The RMOs include:

- Expanding research and development for substitutes for SF_6 in DoD applications,
- Developing a mandatory DoD policy for leak detection, capture and reuse,
- Leveraging research and development being performed by the Electric Power Research Institute regarding substitutes for use in electrical infrastructure, and
- Evaluating the feasibility and cost of stockpiling SF_6 for critical uses.

The fact that DoD would need a baseline for SF_6, and means to reduce its use, was underscored on 5 October 2009 when President Obama issued Executive Order (EO) 13514, Federal Leadership in Environmental, Energy and Economic Performance. Aimed at making broad improvements in the sustainability of the federal government, the EO requires all federal agencies inventory their GHGs and set targets to reduce their emissions by 2020.

The SF_6 RMOs were endorsed for implementation by the executive-level EC Governance Council at its annual meeting on 13 October 2009.

Conclusion

The military services have many critical uses for SF_6, and awareness is growing that the gas is a potent global warmer for which cost increases and restrictions are on the horizon. The collaboration between the CAASSC and CMRMD resulted in an expedited and thorough assessment of the risks and the development of RMOs to manage the risks. However, as there are currently no suitable SF_6 substitutes for most military operations, finding, testing, and qualifying substitutes may be a long-term effort. All of these factors point to the need for a well-organized plan for minimizing releases until substitutes are developed, tested and deployed. ⚓

CONTACTS

Steven Gibb
Noblis, Inc.
703-610-2441
steve.gibb@noblis.org

Paul Yaroschak
Office of the Secretary of Defense—
Acquisition, Technology & Logistics
(Installations & Environment)
703-604-0641
DSN: 664-0641
paul.yaroschak@osd.mil

Elmer Ransom
Environmental Management Staff,
Commandant of the Marine Corps
703-695-8302
DSN: 225-8302
elmer.ransom@usmc.mil