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Guest Perspective
MANAGING RISKS AND IMPACTS OF EMERGING CONTAMINANTS

By Andrew Rak

There is growing public interest in emerging contaminants across the federal government, from regulatory to science and other agencies. Emerging contaminants are chemicals or materials that have pathways to enter the environment and present potential unacceptable human health or environmental risks. They either do not have regulatory peer-reviewed human health standards or the regulatory standards are evolving due to new science, detection capabilities, or pathways. Because they can pose significant public health and environmental risks and can be mismanaged due to the paucity of data, challenges exist in coordinating how federal agencies and private entities identify, assess, and respond to them. One model of a formal program for assessing emerging contaminants is presented along with an example of how a greenhouse gas — sulfur hexafluoride (SF6) — was evaluated under the program.

In the broadest sense, risk is any exposure, event or development that has the potential to threaten or compromise the successful functioning of an organism or organization. For this reason, government agencies, businesses, and non-governmental organizations — like living things — keep an eye out for emerging threats.

Modern practitioners of risk assessment have developed tools that help organizations understand how they contribute to, or are affected by, new or changing threats. Organizations that develop processes to anticipate changes in a chemical's or material's risk profile can proactively adapt to changing regulations and/or market availability. The risk profiles must be multi-dimensional and be comprised of the probability and severity posed by a chemical's or material's availability, health effects, or environmental impact.

Building on fundamental principles from the 1997 report by the Presidential/Congressional Commission on Risk Assessment and Risk Management, the Defense Department's (DoD) Emerging Contaminants Impact Assessment protocol evaluates new risk information on chemicals or materials that may directly or indirectly affect DoD personnel and operations. Here, "risk" broadly refers to impacts on the DoD enterprise, which encompasses the totality of the department's national security mission and is not limited to environmental and safety risks. The impact assessment process culminates in the identification of specific risks along five key criteria and identifies risk management actions to minimize adverse impacts on DoD.

The DoD Emerging Contaminants Impact Assessment paradigm relies on experts' input and other sources of information to deliver science- and experience-based analyses of the potential impacts posed by an emerging contaminant. Tracing the evaluation of SF6 is illustrative of the process and may show how impact assessments can prompt new approaches and actions in addressing enterprise and environmental risks.

SF6 is a chemical that contributes to climate change at 23,900 times the global warming impact of carbon dioxide, the most commonly cited greenhouse gas. It also has an atmospheric lifetime of 3,200 years, which extends this impact. Implementing new practices to reduce the use of one pound of SF6 is equivalent to retiring 11 tons of carbon.

The preliminary steps of the impact assessment protocol involve identifying, examining, and selecting chemicals or materials for further scrutiny should the department's needs and priorities warrant more detailed review and response.

As new risk information is identified, a determination is made whether to conduct a qualitative impact assessment. Engaging experts from across DoD brings key internal stakeholder groups together to address risk, regulatory and scientific information and current DoD processes and practices. During the impact assessment, experts respond to a set of probing questions to examine how potential new risk information may affect five DoD functional areas: 1) readiness and training; 2) acquisition, research, development, testing and evaluation (RDTE); 3) environment, safety, and occupational health (ESOH); 4) production, operations, maintenance, and disposal (POMD); and 5) cleanup/restoration. These five distinct yet cross-cutting functional areas encompass the entirety of the department's mission and responsibilities. Defining risks in these five areas assists the department in determining where resources should

be placed to better position the department to continue meeting mission requirements.

While SF6 has been recognized by the electric power industry as an emerging issue for several years, the potential impacts on DoD resulting from tighter risk reduction efforts were only highlighted after SF6 was singled out during the identification process. A nontoxic, odorless gas, SF6 is produced for various industrial, electronic and military purposes and in the production of magnesium and aluminum. About 80 percent of its usage by volume is by the electric utility industry in equipment to regulate high voltage transmissions of electricity across regional grids, but it also has several military applications. The identification process for SF6 prompted further review of the chemical based on the climate risks it poses and the possibility it will be regulated.

The experts are provided with the results of an analysis that examines the probability and consequence of changes in federal, state, and sometimes international agencies' risk and regulatory findings, as well as applicable scientific developments such as new detection capabilities. The analysis includes preliminary information on how a material or chemical is used by the DoD across a range of activities. Researching how a material is used can be quite challenging as the department has a broad industrial base, extensive manpower and occupational categories, internationally based installations, and cutting-edge and often classified technologies. For this reason, expert input is crucial for a large and complex organization in order to understand the applications, sources, supply chains, and potential ways to mitigate impacts or find substitutes for chemicals of concern. The analysis — which is strengthened by active engagement with DoD's internal and external stakeholders, such as industry, academics, other federal agency representatives and professional associations — provides an overall characterization of the potential impacts to the DoD.

In the case of SF6, the impact assessment identified particularly high potential impacts to the "training and readiness," and the "acquisition/RDTE" functional areas. Moderate risks to the POMD and ESOH functional areas were recorded. Adverse impacts to the cleanup program are minimal as SF6 is a nontoxic, odorless gas. Using the results of the impact assessment, the Department can then focus resources in the areas of highest risk and begin to adapt to a pending change in advance of national or international requirements. Given the long lead time required to respond to a change (e.g., phasing it out, replacing it, or stockpiling it) the identification of risks in specific areas is critical in the formulation and implementation of a risk mitigation strategy.

The "decisions" step at this juncture in the DoD protocol hinges on whether the impact assessment finds significant or only minor impacts on DoD functions, leading to a decision to either drop the chemical from further analysis or continue evaluating it. If the impacts are equivocal or moderate, the chemical may remain under consideration for further information gathering. But high impact chemicals, such as SF6, can be nominated for placement on an Action List where they are subject to a more in-depth quantitative impact assessment which elicits greater detail on impacts to the five functional areas identified above.

If the potential impacts are significant, the experts identify and develop a set of risk management options to avoid, minimize, or mitigate the potential adverse impacts posed by the emerging contaminant. The options can involve restrictions on use, additional research to fill key uncertainties, the development of substitute materials with better environmental profiles, and establishing new Best Management Practices in the field.

The preliminary Impact Assessments and engagement with internal and external stakeholders generates awareness within the Department that new strategies for special handling and use reductions may be warranted. It can also trigger research efforts to develop and test substitutes. DoD had already taken a variety of steps to reduce emissions of SF6 and its related climate impacts before the July 2008 listing of the compound on ECD's Action List. The listing will broaden efforts to reduce and replace uses of the gas.

The DoD is currently refining its information on where, how, and how much SF6 is used. New procedures have been implemented for loading and tracking the gas that have reduced use of the chemical by 52,000 pounds a year (the equivalent of retiring 572,000 tons of carbon dioxide annually). A Small Business Innovation Research (SBIR) grant was awarded to develop techniques for reducing or replacing reliance on the chemical.

It appears that there may be viable substitutes for SF6, such as nitrogen or chemical mixtures using nitrogen. The DoD will continue to review its current and planned uses of SF6 to determine where alternative gases can be used while still meeting performance requirements. In addition, the focus will continue on activities where emissions can be reduced through recapture and reuse. DoD is supporting work to develop new infrared leak detection techniques, new equipment for reclaiming the gas during maintenance procedures, and using materials for strengthening the seal of containers of the gas — all efforts to minimize military releases of the gas.

The impact assessment process developed by the DoD embodies the core concepts of probability of events and severity of impacts and relies on many of the key principles identified by the Presidential/Congressional Commission in anticipating and planning for important changes. Many organizations have a range of formal or less formal ways of assessing potential impacts to their operations and the environment. The principles used in the DoD approach could be a model to address other organizations' unique niches, operations, and priorities.

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