Controlling Acquisition Risk via Scanning for Emerging Contaminants

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Making better risk management decisions and investments enables the Department of Defense to expedite and sustain systems acquisition; protect people; maintain operational capabilities; and minimize the likelihood of unanticipated future costs—ideally avoiding such costs altogether. Faced with growing public and governmental interest in environmental issues, DoD is committed to improving its understanding of emerging contaminants and acting early to manage them and other chemical risks. DoD defines emerging contaminants as chemicals or materials that have evolving science (e.g., beryllium); new or unknown exposure pathways (e.g., trichloroethylene and nanomaterials); and new detection capabilities (e.g., perchlorate) that can be reasonably anticipated to lead to regulatory changes.

A new program initiated in 2006 by the Office of the Deputy Under Secretary of Defense for Installations and Environment addresses risks posed to DoD by emerging contaminants while recognizing that DoD's mission capability is a top priority. To more effectively address chemical risks,

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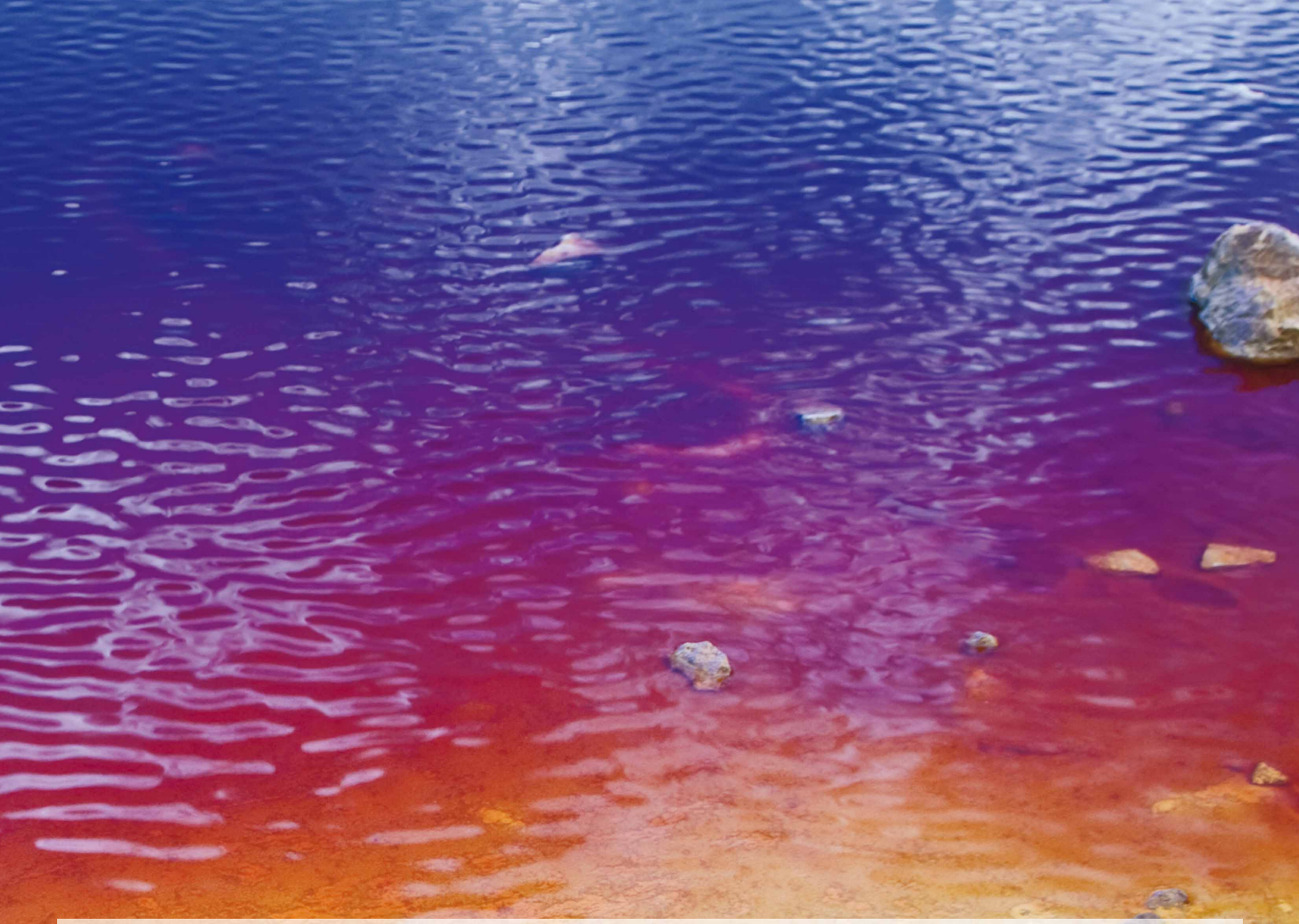


DoD's emerging contaminants program was recently merged with ongoing efforts to help acquisition managers address environment, safety, and occupational health mandates to create the Chemical and Material Risk Management Directorate. The CMRM Directorate helps DoD proactively address risks posed by DoD's chemical selections through its ESOH activities in acquisition, emerging contaminants, chemical management, technology, and green purchasing programs.

The directorate's activities help meet DoD Directive 4715.1E (issued March 19, 2005), which directs DoD to "identify and analyze operational and financial risks of emerging ESOH issues" (section 5.1.4). The directorate also helps meet other mandates, such as DoD Instruction 5000.02, which directs acquisition program managers to eliminate ESOH hazards where possible and to manage risks when hazards cannot be eliminated. The instruction requires acquisition managers to address ESOH risks for each system's life cycle following the eight steps described in MIL-STD-882D, "DoD Standard Practice for System Safety" (see <https://acc.dau.mil/communitybrowser.aspx?id=30309> for a list of the eight steps).

DoD's focus on emerging contaminants helps acquisition program managers recognize future risks and root causes as called for in the *Risk Management Guide for DoD Acquisition, Sixth Edition*: "Root causes are those potential events that evaluators ... determine would adversely affect the program at any time in its life cycle." By addressing emerging contaminants early in the acquisition process, the CMRM Directorate also advances other DoD interests, such as extending the lifespan of platforms; anticipating regulatory shifts, and thus avoiding early obsolescence; and reducing the costs of future operations and maintenance and demilitarization efforts.

Historical Precedent of Emerging Contaminants

History has demonstrated that emerging contaminants can have adverse effects on operating forces, the workforce and their families, the public, and the environment. Concerns about a contaminant's adverse

health effects can result in restricted availability of chemicals or an outright ban on materials, which, in turn, can impact mission-critical industrial-base applications, procurements, and acquisition programs.

For example, stricter standards for the use of hexavalent chromium—a heavy metal used in coating aircraft—may affect system production and maintenance costs and the availability of hex chrome as an anticorrosive agent. Likewise, if concerns about the global warming potential of sulfur hexafluoride [*discussed later in this article*] are addressed in a regulatory scheme, DoD must be prepared to make investments that ensure its mission capabilities are maintained. Well before regulatory standards are developed, DoD can be impacted by concerns about its use of a chemical. For example, even before the Environmental Protection Agency established its toxicity value for perchlorate—which is used in rockets—training at two DoD ranges was curtailed because of concerns over the potential for public exposure to the chemical. Concerns over the chemical perfluorooctanoic acid—which is used in making materials for seals and O-rings and was used in fire-fighting foam, amongst other applications—caused many companies to limit and even cease their use of the compound. Because the chemical is used to create high-performance gaskets, DoD needed to be assured that new products using substitute processes and materials would meet performance criteria.

Proactive Risk Management

Some emerging contaminants require proactive risk management by DoD and defense-related industries to reduce the mission impacts of changes in regulation or market availability. Organizations that anticipate changes in a chemical's or a material's risk profile are better positioned to adapt to shifting regulations and/or market availability. Acquisition managers are challenged to identify and respond to a wide variety of risks that can adversely impact their programs. Early awareness and action will ensure that the acquisition program can meet cost, schedule, and performance expectations. Early action can even lower life cycle costs.

Leveraging the information and risk management options generated by the CMRM Directorate can help acquisition managers effectively address ESOH and other risks in their overall risk management process, as outlined in MIL-HDBK-881, "Work Breakdown Structures for Defense Materiel Items" (see <http://www.acq.osd.mil/pm/currentpolicy/wbs/mil_hdbk-881A/milhdbk881A/webhelp3/milhdbk881a.htm>). In addition to following mandates outlined in DoD Instruction 5000.02 and following procedures for reporting ESOH risks and generating sound programmatic ESOH evaluations, some key risk management practices are:

- Being aware of what emerging contaminants have been identified as of interest to DoD
- Funding research to explore, develop, or demonstrate the viability of alternative materials and processes
- Selecting environmentally friendly alternatives and minimizing the use of known hazardous materials and emerging contaminants to only those applications where no qualified alternatives exist.

Emerging Contaminants Impact Assessment Process

The DoD emerging contaminants impact assessment is carried out by the CMRM Directorate and DoD subject matter experts. The process evaluates new risk information on chemicals or materials that can assist DoD acquisition professionals in their decision-making process. Impact assessments provide key information that can be used at appropriate points in the acquisition process for assessment, decision making, and risk management. Risk profiles for emerging contaminants reflect impacts to the DoD enterprise—not just ESOH impacts, but a range of activities. Risk profiles, therefore, encompass the totality of the department's national security mission. The information generated in these assessments can help acquisition program managers plan ahead and influence the system design by answering questions about what materials may be impacting DoD 10 to 15 years from now, possibly leading to early decisions to "design out" certain chemicals or materials. Tools and resources on the process are available within the ESOH special interest area in the Acquisition Community Connection (<https://acc.dau.mil>) and within DENIX (<https://www.denix.osd.mil/MERIT>), or the Defense Environmental Network and Information eXchange.

The emerging contaminants impact assessment process begins with the early identification of emerging contaminants and an assessment of evolving science and the likelihood of regulatory shifts. With support from the U.S. Army Center for Health Promotion and Preventive Medicine, the CMRM Directorate conducts ongoing and extensive searches for emerging contaminants. The U.S. Army Center for Health Promotion and Preventive Medicine experts review periodicals, scientific journals, advanced notices of proposed rulemakings, and developments in European and U.S. locations considered early adopters of regulatory shifts—such as Massachusetts and California—to identify emerging contaminants that may be of interest to DoD. The process seeks to identify regulatory trends and shifts in chemicals that pose consequences for DoD's mission, business areas, personnel, the public, or the environment. By scanning that information, the CMRM Directorate determines which chemicals or materials are currently being used by DoD—or may be used in the future—and in what applications.

Phase I Impact Assessment

Once an emerging contaminant has been identified to have some interest or risk to DoD, a qualitative Phase I Impact As-

sessment is conducted. The assessment is divided into two parts, with the first part evaluating the likelihood of changes in toxicity values and regulatory status, and the second part estimating the prospect of specific impacts across a range of DoD functional areas.

During the impact assessment, subject matter experts respond to a set of probing questions to examine how potential new-risk information may affect the five DoD functional areas:

- Acquisition, research, development, testing, and evaluation
- Environment, safety, and occupational health
- Training and readiness
- Production, operations, maintenance, and disposal
- Cleanup/restoration.

Those five distinct yet cross-cutting functional areas encompass the entirety of the department's mission and responsibilities. As DoD experts deliberate on a chemical's risk, they are asked to focus on specific questions related to acquisition, such as:

- Will key research be delayed?
- Will key research be terminated?
- Will DoD be able to acquire systems, subsystems, or spare parts containing the material?
- Can DoD build inventories from current suppliers?
- Are substitutes available?
- Will DoD experience delays in procurement?
- Will the price of DoD acquisitions increase?
- How much time and money will be required to redesign systems so the material will not be required?
- How much time and money will be required to develop substitutes?
- Will suppliers leave the market?
- How many suppliers will remain to satisfy military requirements?
- Will DoD be faced with single-point failures?
- Will DoD suppliers have to make capital improvements?
- Will DoD suppliers have to modify their operations?
- Will DoD face increased testing, specification, and evaluation requirements?

Phase II Impact Assessment

The degree of consensus and variation in the experts' responses to those questions are carefully recorded, and they assist in determining whether more detailed quantitative analysis is warranted. If more analysis is required, experts must consider which chemicals should be placed on the action list of chemicals that pose high risks to human health. At that point, a more thorough evaluation—called a Phase II Impact Assessment—is conducted, which can result in the development of risk-management options for the higher-risk chemicals. The steps can include new policies, information-sharing mechanisms, or research; and can shape where resources could be placed to better position DoD to continue meeting its mission requirements.

Engaging experts from across DoD brings key internal stakeholder groups together—including input from the acquisition and ESOH communities—to address risk, regulatory, and scientific information; and current DoD processes and practices. The results also help inform DoD staff about life cycle and total ownership cost factors.

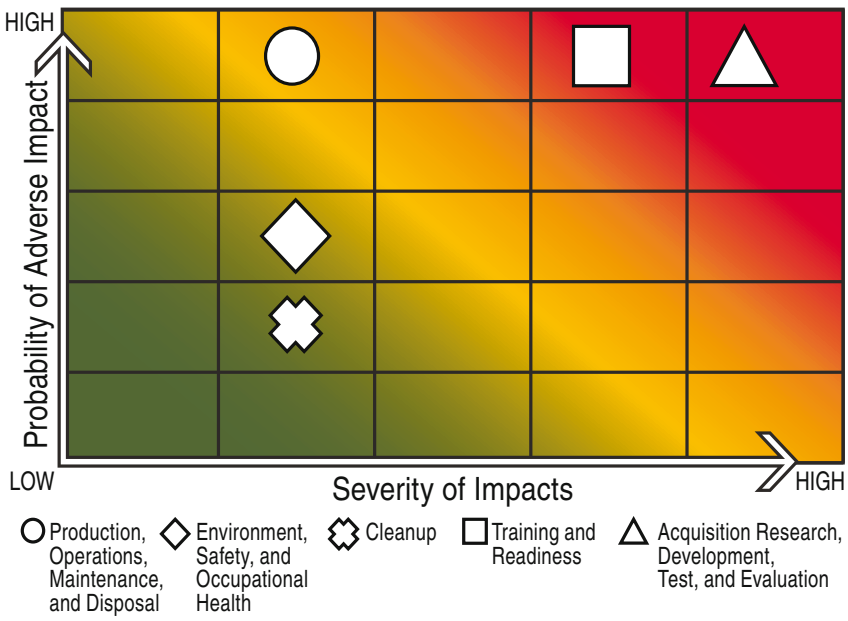
SF_6 Case Study

Tracing the evaluation of a key greenhouse gas, sulfur hexafluoride (SF_6), is illustrative of the analytical process and may show how impact assessments can prompt new approaches and actions in addressing enterprise-wide risks.

SF_6 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. Implementing new practices to reduce the use of one pound of SF_6 is equivalent to retiring 11 tons of carbon in the atmosphere.

While SF_6 has been recognized by the electric power industry as an emerging issue for several years, the potential DoD-wide impacts of tighter risk reduction efforts were highlighted after SF_6 was identified by DoD clean air experts and during a CMRM Directorate review process. A nontoxic odorless gas, SF_6 is produced for various industrial, electronic, research, and military purposes; and is used 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

Impact of Possible SF_6 Regulatory Limits on Key DoD Functions



electricity across regional grids, but it also has several key military applications.

The Impact of Possible SF_6 Regulatory Limits figure illustrates the results of the overall Phase I Impact Assessment for SF_6, taking probability and severity of impacts into account. The figure summarizes an analysis of which DoD functional areas are most likely to be affected by possible changes in the management of sulfur hexafluoride risks.

Possible SF_6 regulations (i.e., a proposed greenhouse gas regulatory scheme) would pose high risks to the acquisition, research, development, testing, and evaluation functional area in addition to training and readiness. The subject matter expert responses to the specific acquisition, research, development, testing, and evaluation questions noted previously in this article led to a high-risk ranking for this functional area in the evaluation of SF_6. Risk management options are being explored and developed to avert and minimize unacceptable risks to national security.

After Contaminant Identification

To date, thousands of chemicals have been scanned, and 24 contaminants have been assessed by the CMRM Directorate. Of those, seven have been found to warrant action-list status and more in-depth review because their potential impact appears to be significant. Some examples of action-list chemicals are perchlorate, an oxidizer used to propel missiles, flares, and munitions; the explosive RDX; the solvent TCE; the fuel constituent naphthalene; hexavalent chromium, a heavy metal used in coatings; the heat-resistant metal beryllium; and sulfur hexafluoride.

Once placed on the action list, the next step is to conduct a Phase II Impact Assessment, which is a more thorough, quantitative evaluation of the likely impacts and costs involved with the elimination or changed usage of the chemical. More important, the assessment articulates risk management options for DoD program managers. Those options can range from developing viable substitute materials to implementing new pollution prevention measures to investing in cleanup technology. The results of the Phase II Assessment are then presented to the Emerging Contaminants Governance Council, which is chaired by senior DoD leaders. In addition to sharing information across DoD, the council provides advice on strategic investments and policies by endorsing actions that acquisition program managers can implement to DoD's future benefit.

DoD and Industry Partnerships

To advance information gathering and dissemination throughout the military services, the CMRM Directorate established the Materials of Evolving Regulatory Interest Team. MERIT consists of individuals from the military services and involves program offices and agencies from across DoD. MERIT's quarterly meetings are open to any interested member of the DoD workforce and those whose job responsibilities are potentially affected by emerging contaminants. Meetings can be attended via the Web or in person. MERIT assists in the rapid compilation and distribution of information on the current status of contaminants and the best available science and technology.

DoD is also building partnerships with industry representatives to identify opportunities and obstacles to adopting alternative chemicals or other improvements in industrial materials and processes. Recent efforts have involved actively working with the NAEM (formerly known as the National Association for Environmental Management) and other industry representatives to identify and respond to the challenges posed by the European Union's sweeping new chemical regulation known as REACH (see <http://www.buyusa.gov/europeanunion/reach.html> for more information) in addition to any other challenges that may arise. The CMRM Directorate is also involved with efforts to benchmark systems and methods being used to rank chemical hazards to improve chemical selection and management systems. The move to "green chemistry" [*environmentally friendly chemicals*] is likely to have multiple benefits for acquisition managers in reducing life cycle costs, avoiding obsolescence challenges, and supporting documentation of programmatic ESOH evaluations.

DoD is committed to improving its understanding of emerging contaminants and acting early to manage them and other chemical risks.

Later this year, the CMRM Directorate expects to release an evaluation of what kind of toxicity information is most helpful at different junctures in the acquisition process to aid in identifying the environment and health risks of key chemicals.

The CMRM Directorate supports a process to facilitate informed risk management decision making that ensures ESOH issues are addressed in the acquisition process in addition to other DoD functional areas. More information on DoD's emerging contaminants program and specific contaminants of interest can be found on the program's Web site at <https://www.denix.osd.mil/MERIT>.

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