

OES 2022-03

October 2022

HFC Phasedown Impacts Critical Operations

Introduction

This Operating Experience Summary (OES) provides information about operational impacts to critical systems from regulations restricting availability of hydrofluorocarbons (HFCs).

HFCs are a class of potent greenhouse gases used as refrigerants, solvents, propellants, and fire suppressants, and in scientific equipment. As part of the American Innovation and Manufacturing (AIM) Act of 2020, the U.S. Environmental Protection Agency (EPA) developed regulations and a schedule for reducing HFC import, production, and consumption from 2020-2036. The phasedown restricts the supply of manufactured or imported HFCs; it does not directly apply to end users.

In November 2021, the Department of Energy (DOE) published an Operating Experience Level 3 (OE-3) Document, *Hydrofluorocarbon Phasedown*, that recommended DOE programs and sites develop plans to procure necessary HFCs to preclude potential impacts on DOE operations.

This OES highlights DOE site difficulties with procuring HFCs for mission critical activities, highlighting the importance of identifying operational impacts that may arise from the HFC Phasedown.

Background

The HFC Phasedown became effective January 1, 2022. The phasedown schedule is provided in Table 1.

Manufacturers are expected to reduce production of specific HFCs with high global warming potentials (GWPs) to meet this schedule. DOE program and

site consumers of these chemicals should prepare for the curtailment and possible elimination of high purity or high GWP HFCs.

Table 1: HFC Phasedown Schedule

Years	Percent of Baseline	Percent Reduction
2011-2013 (Baseline)	100%	0%
2020-2023	90%	10%
2024-2028	60%	40%
2029-2033	30%	70%
2034-2035	20%	80%
2036 onwards	15%	85%

As stated in the OE-3, there are four options for addressing the phasedown of HFCs:

1. Research and implement alternatives.
2. Obtain an essential use allocation allowance¹ for production of HFC.
3. Develop capture and reclamation systems to reuse HFC.
4. Stockpile HFC in a repository.

The EPA has developed regulations for the capture, reclamation, and reuse of HFC, specifically for HFC used as refrigerants. This secondary market of used HFC will not be directly impacted by the phasedown.

Discussion

At least two mission-critical DOE operations have already been impacted by the HFC Phasedown. This OES details each incident and the DOE response.

¹ Allocation allowances assign priority for production of HFCs within the phasedown schedule; they do not compel the manufacture or import of specific HFCs.

1. Lawrence Livermore National Laboratory (LLNL)

The LLNL Diffractive Optics Group designs and manufactures custom diffractive optics. They provide critical optical components for laser-based missions within LLNL, the U.S. Department of Defense (DoD), and research organizations worldwide. An essential step in the optics manufacturing process is the use of trifluoromethane (CHF₃ or HFC-23) for plasma etching. Annual CHF₃ process consumption is approximately 10 pounds, usually purchased as three, 10-pound containers every three years.

CHF₃ is a potent greenhouse gas, with a GWP of 14,800.² It is commonly used for plasma etching and a fire suppressant under the DuPont tradename FE-13.

In 2022, LLNL CHF₃ stockpiles were depleted and their current CHF₃ supplier was unable to provide additional CHF₃, due to implementation of the HFC Phasedown. LLNL staff approached other DOE sites and suppliers to try and obtain enough CHF₃ to continue their plasma etching process. After two months of research, LLNL was able to purchase a limited amount of CHF₃ from an alternate supplier.

2. Savannah River Tritium Enterprise (SRTE)

SRTE is operated by Savannah River Nuclear Solutions for the National Nuclear Security Administration (NNSA). Within the tritium enterprise, HFCs are employed as refrigerants in multiple operations supporting DoD weapon commitments. SRTE recycles tritium from dismantled nuclear warheads and depleted DoD tritium reservoirs and extracts tritium from producing rods irradiated at a commercial nuclear power reactor. The extracted tritium is recycled, purified, and repackaged for DoD use in maintaining the nuclear stockpile.

SRTE uses HFC in low-temperature processes and in specialized laboratory equipment, neither of which have current, commercially available alternatives. Additionally, since SRTE uses radioactive hydrogen (tritium) gas, there are significant safety concerns with the use of commercially available flammable refrigerants as alternatives to HFC.

SRTE identified the appliances that directly support DoD weapon commitments and requested mission-critical military end use (MCMEU) HFC allocation allowances from DoD. MCMEU allocations can only be used for the appliances designated in the request. Other mission-support appliances at SRTE that use HFC but did not qualify for the MCMEU allocation allowances must still obtain HFC from commercial suppliers, with availability subject to the HFC Phasedown restrictions.

As part of the MCMEU allocation process, SRTE must report HFC use to DoD annually. The SRTE allocation was only made for calendar year 2022 and has temporarily been paused since the Office of the Secretary of Defense has not yet signed the memorandum of understanding (MOU) with NNSA. An allocation request for 2023 has been submitted but has not yet been approved.

Planning and Response Initiatives

Several DOE programs are developing guidelines and protocols to address reduced HFC availability.

1. DOE Data Center Optimization Initiative (DCOI)

The DOE DCOI Community of Interest is conducting data calls to determine HFC usage by its members. HFC is primarily used in refrigeration (chillers) and fire suppression at data centers. A primary concern of the DCOI is a potential lack of replacement HFC for refrigeration, as cooling is critical to data center operations. Fire suppression systems using HFCs may also become unusable if supply is limited as a result of the phasedown.

2. DOE Next-Generation Cooling Research and Development

The DOE Building Technologies Office (BTO) has created a strategy for developing and deploying low GWP alternatives to HFC for use as refrigerants.

BTO is providing funding for research and development into next generation cooling technologies and is also working on improving the efficiency of current refrigeration systems using HFCs.

² Title 40 of the Code of Federal Regulations, Part 98, Table A-1.

3. HFC Task Team

The DOE Clean Air Working Group/Fugitive Emissions Working Group (CAWG/FEWG) has created a task team to identify options for DOE sites and offices to respond to the HFC Phasedown. Activities to date include development and distribution of communications regarding the HFC Phasedown, assisting sites like LLNL and SRTE in procuring HFC, fostering discussion among sites about HFC alternatives, and developing guidance for HFC repositories.

The HFC Task Team recently assisted Y-12 with dispositioning a surplus refrigerant (R-123) by connecting it with SRTE, who continues to have a need for the material. Over the next two years, Y-12 will transport the refrigerant to SRTE where it will continue to be used in existing equipment.

The HFC Task Team provides updates at the quarterly CAWG/FEWG meetings and will continue to distribute information (such as this OES) regarding the HFC Phasedown and DOE efforts to procure HFC or alternatives.

Recommendations

DOE sites and offices should review current HFC usage and procurement to plan for the impact of the HFC Phasedown. If usage is not already known, sites could start by reviewing HFCs reported into the Sustainability Dashboard as part of DOE's corporate GHG accounting process.

DOE programs are encouraged to explore and develop alternatives to HFC in existing equipment and processes since high-purity HFCs will be more difficult to procure as the HFC Phasedown is implemented.

DOE sites can share their best practices and lessons learned with the CAWG/FEWG and DOE's Operating Experience Program. The CAWG/FEWG provides a quarterly forum for sharing information between DOE sites and offices. Lessons learned regarding HFCs can be shared and posted at DOE's Operating Experience webinars and website:
<https://doeopexshare.doe.gov/>.

Sites may also include an HFC summary in their 2021 Annual Site Environmental Report (ASER). Providing a description of current HFC uses, possible challenges, and strategies to enable continued mission activities will help the Department address the HFC Phasedown.

Conclusion

The HFC Phasedown will require sites develop strategies to ensure HFC curtailment does not impact operations. While replacements for HFC are expected for commercial equipment, the unique nature of the DOE mission makes it likely that specific operations will be impacted by the HFC Phasedown. Indeed, multiple sites have already been impacted by the HFC Phasedown, and there are several initiatives for addressing HFC use underway within DOE. DOE sites and offices are encouraged to survey their operations for HFC use and develop a long-term strategy to ensure the HFC Phasedown does not curtail mission activities.

References & Additional Information

42 U.S. Code §7675 – [American Innovation and Manufacturing Act](#)

Title 40 Code of Federal Regulations, Part 84 – [Phasedown of HFCs](#)

86 Federal Register (FR) 55116, October 5, 2021 – [Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program Under the AIM Act](#)

86 FR 57141, October 14, 2021 – [Notice to Grant Petitions for Sector-Specific HFC Regulations](#)

EPA – [Protecting Our Climate by Reducing Use of HFC](#)

DOE Operating Experience Level 3 Document, November 2021 – [Hydrofluorocarbon Phasedown](#)

The Office of Environment, Health, Safety and Security (EHSS), Office of ES&H Reporting and Analysis publishes OES articles to promote safety throughout the DOE Complex through the exchange of lessons-learned information among DOE facilities and program offices.

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