October 27, 2023

California Air Resources Board (ARB)

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Re: Senate Bill 1206 Assessment Report: Request for Information, Section 8, Question 35

The Halon Alternatives Research Corporation, Inc. (HARC) appreciates the opportunity to provide information in response to the above RFI on Senate Bill 1206. HARC is a non-profit trade association formed to promote the development and approval of halon alternatives that serves as an information clearinghouse and focal point for cooperation between government and industry on issues of importance to special hazard fire protection. HARC members encompass all levels of the fire protection industry including agent manufacturers, equipment manufacturers, distributors/installers, recyclers, and end-users.

The fire protection industry fully supports the goal of minimizing non-fire emissions/discharges of fire protection agents and is committed to continuing to contribute to both ozone layer and climate change protection. The overriding concern of the fire protection industry, however, is the reduction of risk to people and property from the threat of fire and explosion through the use of products and systems proven to be effective. With the aim of ensuring that these goals are achieved, the fire protection industry has developed a voluntary code of practice focused on minimizing emissions of HFC fire protection agents and a recycling code of practice aimed at ensuring that halogenated clean agents are recycled in a safe and environmentally sound manner. As a companion to the code of practice, an HFC emissions estimating program (HEEP) was developed that collects data on sales of HFCs for recharge of fire protection equipment as a surrogate for emissions. Compiled data of estimated emissions of HFCs from fire protection equipment have been submitted to EPA and published each year since 2002.

Impact of Senate Bill 1206 on Fire Protection Uses of HFCs

The following HFCs have historically been used for fire protection in California: HFC-227ea, HFC-125 and HFC-236fa. HFC-227ea and HFC-125 are used mainly in total flooding fire suppression systems to protect facilities where a clean agent is needed such as data centers. In addition, they are used in military and aviation applications. HFC-236fa is used in portable fire extinguishers for industrial and military applications. All three of these HFCs have GWPs higher than 2,200. Under Senate Bill 1206, bulk sale of these HFCs is prohibited on January 1, 2025.

The use of HFCs in new total flooding fire suppression systems and portable extinguishers in the United States has been reduced significantly due to the GWP-weighted allowance allocation system in the AIM Act. There are low GWP or no GWP alternatives for most of these uses.

While there are numerous HFC-based total flooding fire suppression systems and portable fire extinguishers in California that will continue to be maintained for many years, servicing of this equipment is performed using recycled HFCs and would not be directly impacted by Senate Bill 1206.

However, there are some important fire protection uses of HFCs in California with high societal value that currently have no alternatives. These include the protection of engine and crew compartments on military ground vehicles, naval ships and military aircraft, and the lavatory systems on commercial aircraft. In addition, there may be some facility uses of HFCs where current alternatives do not provide adequate protection. As it will not be practicable for these users to comply with the January 1, 2025, prohibition, ARB will need to find some mechanism to provide relief for these critical fire protection uses of HFCs in California.

AIM Act Preemption

The AIM Act has a preemption provision (42 USC 7675(k)(2)) for any state law that would restrict HFCs for an application for which there is a mandatory allocation of allowances, such as onboard aerospace fire suppression and mission critical military applications. Preemption is automatic until December 27, 2025, but can be extended another 5 years if EPA authorizes an additional mandatory allowance, which could take it out to the end of 2030. The AIM Act preemption provisions could be a means to provide relief for some of these important uses of HFCs that have no alternatives. However, it is not clear that it would cover all uses that don't have alternatives. In addition, some of these HFC uses are likely to extend beyond 2030.

Definition of Bulk

Another possible means of providing relief for important fire suppression uses of HFCs is in the definition of bulk. Historically, total flooding fire suppression system cylinders have not been defined as bulk cylinders. They do not meet the definition cited in Senate Bill 1206 and shown below. They are not used for the transportation or storage, and the HFCs they contain do not have to be transferred to another container or piece of equipment in order to realize their intended use. Total flooding system cylinders are pieces of equipment that are part of a larger system that includes piping, nozzles and detection. EPA defined them as bulk cylinders under the AIM Act to close a potential loophole that would have allowed total flooding fire suppression systems containing HFCs to be filled overseas and imported without allowances. That situation is not relevant in California under Senate Bill 1206. HARC believes that there is ample technical justification for ARB not to define total flooding system cylinders as bulk cylinders in regulations implementing Senate Bill 1206.

"Bulk" means a regulated substance of any amount that is in a container for the transportation or storage of that substance such as cylinders, drums, ISO tanks, and small cans. A regulated substance that must first be transferred from a container to another container, vessel, or piece of equipment in order to realize its intended use is a bulk substance. A regulated substance contained in a manufactured product such as an appliance, an aerosol can, or a foam is not a bulk substance. (Section 84.3 of Title 40 of the Code of Federal Regulations)

Overview of Fire Suppression Uses of HFCs and Alternatives

In this submission we use the term halogenated clean agents (HCAs) to refer to the fluorinated chemicals used in total flooding fire suppression systems and portable fire extinguishers. HCAs used in total flooding fire suppression systems are also commonly referred to as gaseous fire extinguishing agents.

The following overview of HCAs used for fire suppression and their possible alternatives is broken down into three use categories: total flooding fire suppression, onboard aircraft fire suppression, and military.

Background on total flooding fire suppression

HCA fire suppressants occupy a specialty market where there is a need to protect items that otherwise would be damaged by a fire extinguishing agent itself or a slow extinguishment process, and in enclosed spaces where many other fire suppressants would pose a risk to human health and safety. These specialty applications have unique challenges to providing fire and life safety. The diversity of applications and the unique requirements of individual facilities make it very challenging to claim that an alternative, non-HCA technology is viable across a general use category such as data centers or control rooms. Each data center, for example, will have different criteria and requirements for the fire protection technology selected.

Clean agent fire systems are not normally required by code. They are an added expense to mitigate an unacceptable risk of losing assets, data or incurring downtime for a high-tech or historical preservation facility as a result of a fire. This risk analysis includes high value assets and business continuity, but also societal impact and security with the loss of critical services in the event of fire. In the interconnected electronic world, loss of telecommunications and internet access can pose significant societal impacts. This makes the grouping of applications for regulation within the category very difficult. In some cases, the assets within the protected hazard are critical, in others it is the function of those assets within the protected space that are of value, not necessarily the assets themselves.

HCAs used in total flooding fire suppression

The HCAs used for total flooding fire suppression are: HFC-227ea, HFC-125, FK-5-1-12, and HB-55 (a blend of FK-5-1-12 and HFO-1233zd). The chemical, physical, and thermodynamic properties, especially vapor pressure, differ among these agents and affect their storage, transport, atomization, and vaporization characteristics. These agents are stored as liquids in nitrogen-pressurized containers. Upon actuation of the fire extinguishing system, agent liquid is released into a pipe distribution system and discharged from nozzles into the protected enclosure as a vaporizing spray forming a uniform gaseous agent-air mixture throughout, thus the term “total flooding” fire extinguishing. Widely accepted standards require that the discharge time for systems using HCAs be completed in 10 seconds or less, which assures rapid flame extinguishment thereby minimizing damage to protected assets. The minimum design concentration (MDC) of agent in an enclosure is based on test procedures for the hazard type, described in an applicable national standard such as NFPA 2001, and is further tested and

validated by approval agencies such as UL and FM.

Fire extinguishing systems containing HCAs are used to protect a wide array of asset types in the United States and around the world, including:

1. Server rooms
2. Power supply rooms
3. Electrical switch gear rooms
4. Hospital (e.g., MRI labs)
5. Document storage vaults.
6. Cultural heritage structures
7. Emergency dispatch centers ("911" call centers)
8. Anechoic chambers.
9. Chemical storage rooms
10. Flammable liquids
11. Battery Energy Storage Systems (BESS)
12. Marine
13. Oil and gas exploration
14. Military
15. Naval ships
16. Aerospace

Non-HCA Clean Agent Alternatives

Inert gases

IG-01, IG-100, IG-55, and IG-541 are approved for use in total flooding fire extinguishing systems in occupied spaces. Inert gas agents are stored in high-pressure cylinders at pressures up to 300-bar or with technology activated by chemical reaction (energetics). Standards require that inert-gas fire extinguishing systems discharge in at most 120 seconds for Class A hazards (solid substances), and in at most in 60 seconds for Class B hazards (flammable liquids). Use of inert gas agents is permitted for occupied spaces provided that exposure of personnel to reduced oxygen concentrations is limited to 5 minutes where oxygen concentrations are 12% or greater.

Technical limitations affecting use of inert gas agents in place of HCAs are mainly due to (1) increased space and weight burden of inert gas cylinders, and (2) where the inert gas agent concentration exceeds 62 percent at sea level equivalent they cannot be used in occupied areas.

Carbon dioxide (CO_2)

Carbon dioxide has a long history as an effective gaseous fire extinguishing agent in limited circumstances to protect against class B hazards. It is used in both total flooding and local-application fire extinguishing systems. However, carbon dioxide is fatally toxic at fire extinguishing concentrations, which severely limits its use in normally occupied enclosures except where certain requirements are met (NFPA 12).

Trends in Clean Agent Use

The use of newly manufactured HFCs for total flooding fire suppression in the US has decreased significantly over the last two years due to the AIM Act and is now very small. Remaining volumes are used in applications that do not currently have alternatives and to supply export markets. New clean agent fire suppression systems are served mainly by FK 5-1-12 and inert gases, and in some cases recycled HFCs.

Overview of Onboard Aircraft Fire Suppression

Although the incidence of in-flight fires is low, the consequences in terms of loss of life are potentially devastating, and the use of HCAs to help guard against such events has been a key aspect of aircraft fire safety for over 50 years. Aviation applications are among the most demanding and critical uses of the fire suppression agents and require every one of their beneficial characteristics. Particularly important are the following:

- dispersion and suppression effectiveness, which must be maintained even at the low temperatures encountered at high altitude,
- minimal toxic hazard to the health and safety of ground maintenance staff and passengers and flight crew, who could be exposed to the agent and any decomposition products for periods as long as several hours, and
- weight and space requirements of the agent and associated fire protection system.

Also significant are short- and long-term damage to aircraft structure or contents resulting from the following:

- the agent or from its potential decomposition products in a fire,
- avoidance of clean-up problems,
- suitability for use on live electrical equipment,
- effectiveness on the hidden fire (the ability to indirectly extinguish fires), and
- the installed cost of the system and its maintenance over its life.

Historically halons were used in active fire suppression systems to protect lavatories, engines nacelles, auxiliary power units (APUs) and cargo compartments, and in handheld extinguishers in the passenger cabin. After 30 years of research, testing and standard development, Halon 1301 systems are still being installed in the cargo compartments, engine nacelles and APUs of all new production aircraft.

Overview Of HFC Use for Onboard Aircraft Fire Suppression and Possible Alternatives

HFC-227ea and HFC-236fa are currently used in lavatory fire suppression systems on commercial aircraft as a replacement for Halon 1301. There are other HCAs in development for this use, but like HFCs they have recently been included in some definitions of PFAS, which could complicate their future development. Based on the nature of the hazard and the small size of the required system, it is possible that a non-PFAS agent such as inert gas or water could be

made to work in this application, however, no testing of these agents for this application has been successfully completed to date. Given the long lead times required to gain approval for the use of a new fire suppressant on aircraft, HFCs will still be installed in lavatories on commercial aircraft well beyond 2025.

Overview of Military Fire Suppression

Military fire protection systems are unique in that they must protect personnel and platforms from the consequences of combat damage and also protect against 'peacetime' fires. Fires due to combat events are generally very fast-growing and relatively large. Fire protection systems are required to counter these threats, often while allowing occupants to remain in the affected spaces. A point to consider when choosing an extinguishing agent for spaces that are normally occupied is whether the enclosure must remain operational during combat operations or can be evacuated. If the enclosure must stay occupied during a fire event, then a limited number of agents are available for consideration due to toxicity concerns. However, if evacuation of the enclosure is an option, a wider range of agents is available similar to commercial applications.

Overview of HFCs Used for Military Fire Suppression and Possible Alternatives

The full range of HCAs and not-in-kind alternatives have been investigated for military applications, including CO2, inert gases, HFCs, dry chemicals, and other gaseous chemicals. For some of these specialized applications, HFCs have been the only alternatives demonstrated to meet these stringent requirements. HFC-125, HFC-227ea, and to a lesser extent HFC-236fa are used for fire and explosion suppression in critical military applications including the following:

- Protection of engine and crew compartments on military ground vehicles
- Protection of machinery spaces, engine spaces, command centers, fuel pump rooms and flammable liquid storage compartments on naval ships and submarines
- Protection of crew compartments and engines on military aircraft

Significant research by the DoD has shown that there are no alternatives to HFCs that meet all military performance requirements. Thus, many of today's fielded weapon systems and support equipment will remain in service for the foreseeable future. Barring mandatory decommissioning, these mission-critical HFC-based fire protection systems will need to be supported to at least 2050 and likely beyond. Fire protections systems on military vehicles, ships and aircraft can realistically only be replaced when major maintenance or modifications/upgrades are carried out since they are normally in service and operating all over the world. System replacements plans are therefore usually established many years (decades) in advance. Given that the military sector is not a significant user of these chemicals in terms of global demand, industry sources have informed militaries that they have no plans to invest additional resources to develop alternative chemicals specifically for these unique applications. Therefore, military investigations into alternatives are limited to those chemicals that are used for other commercial applications.

Conclusion

There are important fire protection uses of HFCs in California with high societal value that currently have no alternatives and will continue for many years. While some of these uses can be served with recycled HFCs, HARC has no information that would inform whether supplies of recycled HFCs would be sufficient to meet all future needs of HFCs for fire protection in California. As it will not be practicable for all HFC users to comply with the January 1, 2025, prohibition, ARB will need to find some mechanism to provide relief for these critical fire protection uses of HFCs in California.

HARC would be glad to meet with ARB discuss these issues in more detail and provide any information we can to assist ARB in implementing Senate Bill 1206.

Respectfully submitted,

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Enclosures

Code of Practice for Use of Recycled Halogenated Clean Agents, April 2015 (referenced in NFPA 2001)

Report of the HFC Emissions Estimating Program (HEEP), 2002–2020 Data, October 2022

Montreal Protocol Fire Suppression Technical Options Committee (FSTOC) Assessment Report, December 2022

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