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American Carbon Registry
980 Ninth Street, Suite 2060
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Re: EMISSION REDUCTION MEASUREMENT AND MONITORING METHODOLOGY FOR DESTRUCTION OF OZONE DEPLETING SUBSTANCES AND HIGH-GWP FOAM

3M is a global science company that never stops inventing. Using 46 technology platforms, our integrated team of scientists and researchers works with customers to create breakthroughs and improve the daily life for hundreds of millions of people. With $30 billion in sales, our 90,000 employees connect with customers all around the world.

3M has been active in the clean agent fire suppression market for the last 25 years and, based on that experience, submits the following comments related to the methodology for emission reduction measurement and monitoring methodology for destruction of halons.

Eligibility of halon 1301 and halon 1211

3M agrees that halon 1301 and halon 1211 should both be eligible for destruction credits and that stockpiles of halon 1301 should not be eligible for destruction credits. Destruction credits should only be granted for destruction of halon 1301 that has been recovered from decommissioned systems for the express intent of preventing the ultimate emission of halon 1301 to the atmosphere. This is an important consideration because, although there are low GWP/no ODP substitutes available for halon 1301 in almost all applications, there are still niche applications in commercial and military aviation that still require halon.

The methodology should clarify the reason for halon system decommissioning may be for the purpose of replacing the agent with a low GWP alternative or because the system is at end of life. In either event, destruction of the halon prevents the halon from going back onto the commercial market or into a halon stockpile and prevents ultimate emission to the atmosphere.

Emission Rates and Additionality Considerations:

Fire suppression systems are closed systems. Halon 1301 has been stored in pressurized systems for years without a meaningful leak rate. These fire suppression systems should be considered insurance systems. The hope is that they are never used to protect life and property. Emissions do occur through accidental discharge or to protect valuable assets in the event of a fire. When a system is decommissioned there is a very robust secondary market that will purchase the agent. Agent on the secondary market is typically sold to recharge an existing system or to a stockpile for future system deployment. Ultimately one must assume that, unless destroyed, all halon will ultimately be emitted. There is no regulation that compels destruction of halon 1301 and it continues to have commercial value.

The primary motivation for this methodology is to incent replacement of existing halon systems with sustainable alternatives, taking halon out of the market and preventing its ultimate emissions to the atmosphere. To achieve this end, the methodology needs to overcome a couple of market barriers.

1. For halon systems that are being decommissioned, the destruction credits generated need to be more valuable than the price paid for halon on the secondary market.
2. For halon systems that are being decommissioned and replaced with a low GWP substitute, the value of the halon destruction credits needs to offset a substantial percentage of the cost of replacing a halon system with a low GWP alternative.

There is no drop-in replacement for halon. The primary low GWP replacements for halon will be Novec 1230 fluid or inert gas. It will take approximately twice as much Novec 1230 fluid to replace halon and inert gas systems will require approximately 32 cylinders of gas for every cylinder of halon. The cost associated with this type of halon replacement project also includes agent costs, engineering costs, replacement of valves and nozzles, minimal piping replacement, and labor costs. A more detailed analysis of these costs is included in the attached Appendix to these comments. Providing 100% CO2 equivalent credit for destroyed halon in the year in which it is destroyed would yield approximately $40/lb of halon destroyed and offset much of the cost of a halon substitution program.

Without 100% destruction credit in the year in which the halon is destroyed, the methodology will have no impact on incenting the replacement of halon systems. Providing 100% destruction credits for halon in the year it is destroyed both reflects the true environmental benefit of preventing the ultimate emissions of the halon and overcomes the financial barrier that exists for replacement of halon with a sustainable alterative. The methodology will be impactful in minimizing further deterioration of the ozone layer and abating substantial greenhouse gas emissions.

Halon Substitute Emissions

The proposed halon destruction methodology calculates substitute emissions based on market share of available substitutes. The attached table from NFPA 2001 (2015 Edition) illustrates the availability of substitutes for halon 1301.

Table 2 **Environmental rating of commonly used gaseous media**

Gas	ODP	GWP[A)]	ATL years
IG-01	0	0	n/a
IG-100	0	0	n/a
IG-55	0	0	n/a
IG-541	0	0	n/a
HFC-23	0	14800	250
HFC-125	0	3500	32
HFC-227ea	0	3220	36.5
FK-5-1-12	0	1	0.014
Carbon dioxide	0	1	n/a

A) IPCC 4th Assessment Report [3].

Please note that the substitutes include very high GWP hydrofluorocarbons (HFCs) and very low GWP alternatives to both halons and HFCs. As discussed in EPA's Endangerment Finding (74 FR 66496; December 7, 2009), EPA determined that hydrofluorocarbons (HFCs) are one of the six key well-mixed greenhouse gases in the atmosphere — in addition to CO2, CH4, N2O, PFCs, and SF6 — whose current and projected concentrations were found to threaten the public health and welfare of current and future generations.

The HFC's commonly used in the total flooding fire suppression market include HFC-23, HFC-227ea and HFC-125. And these HFCs have very high GWPs, especially relative to HFCs sold into other sectors. It is important to note that the Parties to the Montreal Protocol have committed to reach an agreement in 2016 on an HFC phase-down schedule. The EU has already implemented an HFC phase-down schedule and the U.S. EPA is advancing proposals to phase down HFCs in various SNAP sectors. In fact, EPA is currently soliciting comments on the continued need for HFCs is fire suppression.

The fire suppression sector is very well positioned with low GWP alternatives to halon and HFCs that pose lower overall risk to human health and the environment and obviate the continued use of HFCs. The low GWP alternatives include FK-5-1-12 (3M™ Novec ™ 1230 Fire Protection Fluid), inert gas solutions, water mist technology and hybrid (water mist/inert gas mixture) systems. Transition to low GWP substitutes in fire suppression will result in >99% reduction in GWP impact compared to HFC fire suppression systems. Novec 1230 fluid and inert gas systems are already very mature technologies with substantial market share. Inert gas solutions have been commercially available since the mid-1990s and FK-5-1-12 was approved by the SNAP Program in 2002.

The total flooding fire suppression sector is similar to other HFC sectors in that emissions of HFCs will continue to grow as the installed base of systems continues to grow. The atmospheric concentrations of HFC-227ea provide a good illustration of industry emissions since HFC-227ea came into the market as a major replacement for halon (Laube, et.al. 2010). This data is in stark contrast to voluntary industry reporting schemes.

With the understanding that HFC emissions from fire suppression will continue to grow and that mature low GWP substitutes and alternative technologies exist in the market that reduce overall risk to public health and the environment, 3M encourages the American Carbon Registry to disallow generation of halon destruction credits for decommissioned halon systems that are substituted with an HFC. To do otherwise would create the unintended consequence of fostering continued installation of HFC fire suppression systems when the global regulatory initiatives are clearly moving in the opposite direction.

Because there are multiple non-HFC, low GWP technologies that exist that have GWPs of one or less, there is no need to calculate substitute emissions with a moving market share analysis. The calculation of substitute emissions can be made much more objective by clarifying that only agents with a GWP of one or less (AR5) qualify for the methodology and all substitute calculations use a GWP value of one.

Summary

In summary, the proposed methodology for generation of halon destruction credits can be a win-win for stratospheric ozone and the climate. In order to have any impact, however, the value of credits generated need to overcome the cost of replacing an existing halon system with a low GWP replacement. The methodology also needs to avoid the perverse consequence of having halon replaced with an HFC by clearly excluding HFCs as a replacement option for halon.

If additional questions arise as you consider this issue, please don't hesitate to contact me.

Sincerely,

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Appendix

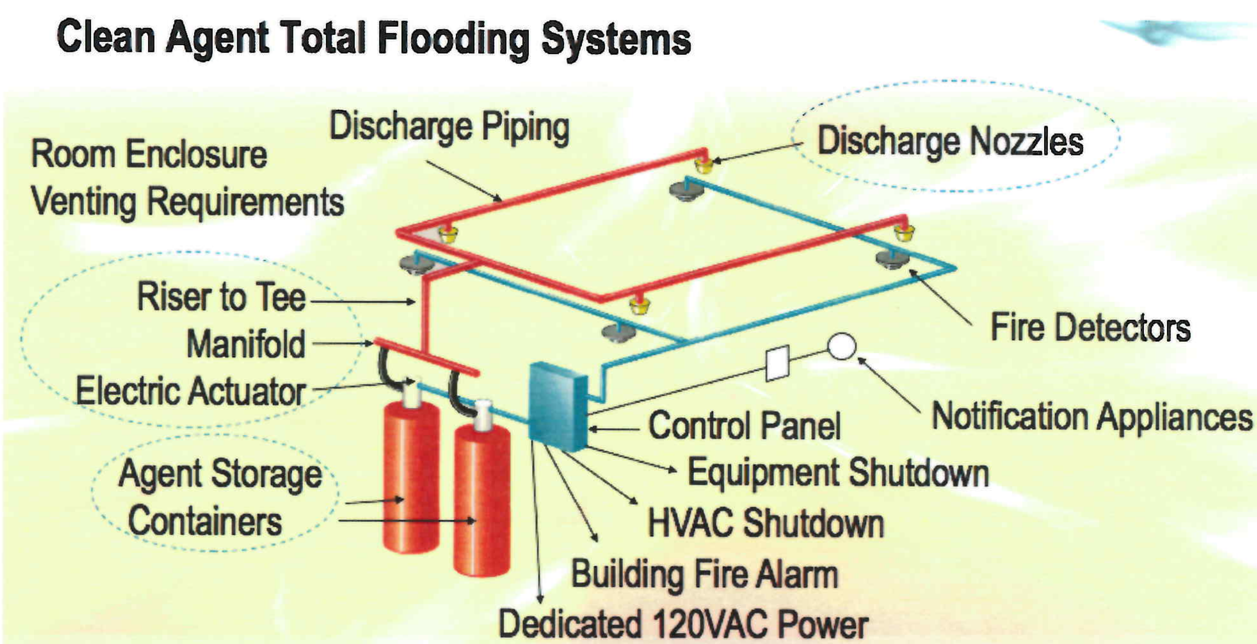
Cost Considerations for Replacement of halon 1301 fire suppression Systems

The purpose of this report is to bring awareness to the costs associated with replacing an existing halon fire suppression system with a sustainable alternative.
Existing fire suppression systems containing ODS (Halon 1301 and Halon 1211) protect vital operations and irreplaceable assets for many companies. Destroying the Halon 1301 without replacing them for an in kind solution would defeat the initial purpose of investing in such an advanced fire suppression clean extinguishing agent system. Therefore, replacing a Halon 1301 system with a sustainable fire suppression system is a key component for the success of a halon destruction methodology.

This report will identify technical challenges and associated costs associated with replacing a halon system with a sustainable alternative. Although multiple alternatives exist, this report will consider replacement with Novec 1230 fluid. Novec 1230 fluid is an in kind replacement and the primary focus of my most recent experience in the market. The following costs will be considered: agent, storage cylinders, valves, manifolds, piping, discharge nozzles, engineering, removal and replacement of existing ODS equipment with Novec 1230 fluid equipment, permits, labor, testing. Novec 1230's physical characteristics allow it to replace existing Halon 1301 systems with the least amount of equipment possible and maintaining a nearly equivalent cylinder storage footprint.

Hardware: System Components

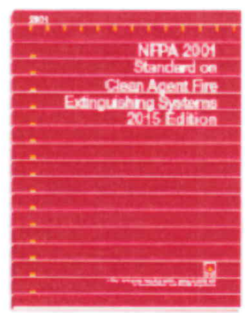
System components in the below illustration depict an existing clean agent total flooding system. Components for a system based on Halon 1301 such as the storage containers(s), actuators, nozzles (shown in dotted circle) are UL listed components only suitable for the agent with which they were tested. Any replacement system must be replaced with a system that has similarly listed UL components. In addition, piping modifications must be made to the manifold, riser to tee and fittings/adapters leading to nozzles. Electrical actuators will require replacement in many cases including supervisory devices that monitor low pressure and sub panels or control modules listed with electric valve actuators. Remaining components are largely not affected by the halon exchange and comprise the automatic fire suppression system in its entirety.



3 Key Categories.

The elements required to transition from a system using Halon 1301 to one using Novec 1230 fluid can be broken down into three categories. 1. Hardware including the clean extinguishing agent (CEA), tank with valve, electrical actuator/control modules, discharge hose, manifold, riser, tee and nozzles. 2. Engineering. Clean agent fire suppression systems are governed by NFPA 2001 and system testing is witnessed by third party listing and approval bodies such as UL and FM Approvals. Consequently, replacing an existing halon 1301 system requires reengineering to determine the modifications needed with the replacement system. This portion of the costs include hydraulic calculations, modification to ACAD shop drawings, refiling with the local Authority Having Jurisdiction (AHJ) and preparation of O&M manuals. 3. Labor costs include removal and replacement of the existing halon 1301 system and coordination of labor and tools to perform the physical modifications to the piping distribution system.

NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems, 2015 Edition



NFPA 2001

1.2 Purpose.

1.2.1 The agents in this standard were introduced in response to international restrictions on the production of certain halon fire extinguishing agents under the Montreal Protocol signed September 16, 1987, as amended.

The costs outlined in the table below are intended to provide ballpark estimates of the costs associated with removing a halon 1301 fire suppression and replacing it with a system containing Novec 1230 fluid. For the purpose of this report, the fire suppression systems are broken down into four different system size categories. The size of a system is determined by the total amount of Halon 1301 lbs in aggregate (multiple tanks may comprise one fixed system). The values noted are estimates based on industry averages for each cost category.

Small <500 lbs, : NZA $55/LB

Large 1,501 lbs < 10,000 lbs,: NZA $50/LB

Medium 501 lbs < 1,500 lbs, : NZA $52/LB

X-Large >10,001 lbs : NZA $49/LB

Halon Destruction Credit, Net Zero Exchange Analysis

System Size	Small		Medium		Large		XLRG	
	Halon 1301	Novec 1230	Halon 1301	Novec 1230	Halon 1301	Novec 1230	Halon 1301	Novec 1230
Design Concentration (Class A)	5%	4.50%	5%	4.50%	5%	4.50%	5%	4.50%
Agent Qty (lbs)	<500		501 < 1,500		1,501 < 10,000		> 10,001	
Example (lbs) Novec 1230 is roughly 2:1 ratio Novec 1230 weight/lb : Halon 1301 wt./lb	499	986	1,496	2,958	5,150	10,186	10,300	20,373
Tank(s) Qty	1	1	2	1-3	6	4-11	11	8 - 21
GWP CO2e (lbs)	7140	1	7140	1	7140	1	7140	1
Environmental impact GWP CO2e (lbs)	3,562,860	986	10,681,440	2,958	36,771,000	10,186	73,542,000	20,373
ODP	12	0	12	0	12	0	12	0
ODP	5,988	0	17,952	0	61,800	0	123,600	0

Halon Destruction Credit, Net Zero Exchange Analysis

	Small Halon 1301	Small Novec 1230	Medium Halon 1301	Medium Novec 1230	Large Halon 1301	Large Novec 1230	XLRG Halon 1301	XLRG Novec 1230
Hardware		$ 22,720		$ 68,160		$ 243,720		$ 487,460
Engineering		$ 1,600		$ 3,200		$ 4,800		$ 6,400
Labor		$ 3,328		$ 6,656		$ 9,984		$ 13,312
Total		$ 27,648		$ 78,016		$ 258,504		$ 507,172
Destruction Value required for Halon 1301 $/lb	$ 55		$ 52		$ 50		$ 49	
Halon 1301 Net Zero	$ 27,648		$ 78,016		$ 258,504		$ 507,172	

Prepared by Luis F Gonzalez, 5/27/16