

March 17, 2017

Environmental Protection Agency  
Climate Change Division (6207A)  
1200 Pennsylvania Ave. NW  
Washington, DC 20460

Re: Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015; 82 Fed. Reg. 10767 (February 15, 2017)

Dear Madam or Sir:

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 over \$30 billion in sales, our 90,000 employees connect with customers all around the world.

Total flooding fire suppression systems protect high value assets from fire when water-based suppression cannot be used (e.g. computer rooms and data centres, control rooms, hospital equipment and records and museum and art galleries). 3M has been active in the clean agent fire suppression market for the last 25 years and 3M commercialized Novec 1230 fluid into total flooding fire suppression in 2003. Based on that experience, 3M submits the following comments.

### **Evolution of Alternatives**

HFC phase-down regulatory frameworks have been discussed since 2009 and are now in place under the Montreal Protocol and being executed in the European Union. In addition, the U.S. EPA has been proposing HFC SNAP status change rules for the past 3 years. All this regulatory activity has been very transparent to the fire protection market and has hastened the adoption of multiple sustainable alternatives to HFCs in fire suppression. Major end users of fire suppression systems continue to shift their specifications for fire suppression systems from HFCs to more sustainable alternatives. The pace of this transition does not appear to be reflected in Table A-146.

Non ODP/GWP alternatives to halon and HFCs 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, CO2 and not-in-kind alternatives such as pre-action water, early detection and dry chemical. Novec 1230 fluid and inert gas

systems are already very mature technologies with substantial market share. Water mist technology has also made inroads over the past few years. Inert gas solutions have been commercially available since the mid-1990s and FK-5-1-12 was approved by the SNAP Program in 2002 and commercialized in the U.S. in 2003.

The attached table from NFPA 2001 (2015 Edition) illustrates the availability of some, but not all, of the low GWP substitutes for clean agent fire protection.

Table 2 Environmental rating of commonly used gaseous media

Gas	ODP	GWP <sup>A)</sup>	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

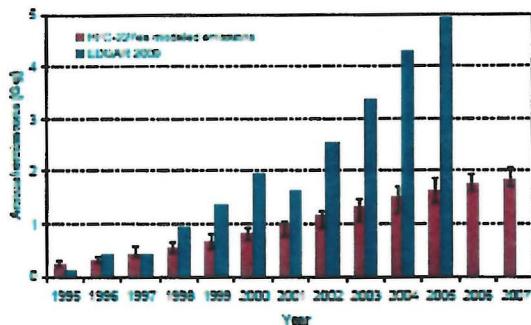
A) IPCC 4<sup>th</sup> Assessment Report [3].

In addition to the investment that has gone into developing low GWP replacements for HFCs, there has also been substantial investment in the systems that utilize low GWP agents. The low GWP substitutes for HFCs are available from the same industry leading system manufacturers that currently sell HFCs, are listed by the same approval bodies and included in the same standards as HFCs. As illustrated by UL listings and FM approvals, every major system manufacturer already sells low GWP substitutes for HFCs and some system manufactures only sell low GWP substitutes for HFCs. A quick review of UL approved total flooding systems will also reveal that investment by system manufacturers over the past 10 years has overwhelming been in systems that utilize sustainable alternatives rather than HFCs.

#### HFC Use and Emissions and Market Share

Although HFC market share in fire suppression has been diminishing since the introduction of No ODP/Low GWP alternatives, HFCs continue to maintain a substantial market share of the U.S. clean agent market and the installed base of HFC systems continues to grow.

3M estimates that the U.S. market share for HFC-227ea and HFC-125 is 45% and 20%, respectively. HFC-23 is sold into very niche applications. 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 provides excellent insight into HFC emissions from the fire suppression sector because the primary use of HFC-227ea is clean agent fire suppression. Also, this data is in stark contrast to voluntary industry reporting schemes.



Taken from Laube, et.al. 2010.

Also consider that the secondary market for HFC-227ea is now saturated. Agent recyclers have acknowledged that supply on the secondary market has so far outpaced demand that there is essentially no market for recovered HFC-227ea. These market conditions suggest that, as systems containing HFC-227ea continue to be decommissioned and the agent is not recycled, the HFC-227ea emission rate is likely to rise to a level not contemplated by existing models.

#### **Suggested Revisions to Table A-146: Fire Extinguishing Market Transition Assumptions:**

3M's assumptions with regard to market share transition from halons to HFCs and Non ODP/GWP alternatives are very different than what is reflected in Table A-146, especially the assumption that the market for HFC-227ea in the mid to late 1990's is only 18% of the original halon market. 3M fully recognizes that, due to cessation of discharge testing and pricing of substitute agents, the clean agent market was substantially smaller after the phase-out of halon. The assumptions in A-146, however, do not appear to consider the technology boom of the late 1990s or the fact that substantially more HFC is necessary per protected space than halon. Appendix I includes the original Table A-146 and a second Table A-146 with 3M recommended edits.

Environmental Protection Agency  
Page 4  
March 17, 2017

### Summary

As you consider updating the U.S. inventory of GHG emissions, please consider these comments related to the fire suppression sector. The market dynamics impacting the evolution and uptake of halon alternatives has meaningfully changed since the original assumptions were established. Please also note that some of the original assumptions with regard to the size of the halon replacement market may need to be reconsidered. Contrary to voluntary industry reporting, measured atmospheric concentration suggest that emissions of HFCs from the fire suppression continue to rise and this should not be surprising given the increasing installed base of HFC fire suppression systems. Future HFC emission rate estimates from the fire suppression sector should also consider that the secondary market for HFCs in fire suppression is saturated and there is essentially no market for recovered HFC-227ea.

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

Sincerely,



Kurt T. Werner, DABT  
Environmental Affairs Manager  
3M Electronics Materials Solutions Division  
3M Center, Building 224-3N-11  
St. Paul, MN 55144-1000  
Work 651-733-8494  
Mobile 651-216-1896  
ktwerner@mmm.com