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Please see below for Trakref's public comment in response to the Draft 1990-2015 Greenhouse Gas Emissions Inventory.

Re: Draft 1990-2015 Greenhouse Gas Emissions Inventory

Fluorocarbons (CFCs, HCFCs, and HFCs) continue to dominate the market share in the United States. In fact, in 2015, approximately 462 million pounds of fluorocarbon refrigerants were consumed in the United States, and that number is expected to rise to approximately 508 million pounds in 2020 (MarketsandMarkets 2015). Above all, when looking at the U.S. refrigerant market size, an important factor is that the leak rate in the United States has averaged ~25% of the share growth in the market, and neither CFCs nor HCFCs are excluded from the outlook.

Yet, Section 1 of the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015 (hereby referred to as Inventory) does not include usage emissions from CFCs and HCFCs, even though these are two of the most prominent greenhouse gases (GHGs) with significant ozone-depleting potential (ODP) and global warming potential (GWP). Section 1.1 attempts to provide an explanation for their exclusion: "As stratospheric ozone depleting substances, CFCs, HCFCs, and halons are covered under the Montreal Protocol on Substances that Deplete the Ozone Layer. The UNFCCC defers to this earlier international treaty. Consequently, Parties to the UNFCCC are not required to include these gases in national greenhouse gas inventories." Though including CFCs and HCFCs may not be "required," this does not discount their emissions and their significant impact. Excluding them from the Inventory misrepresents our GHG emissions and means that we are without a clear view of the total GHG inventory. This is where the discrepancy with the refrigerant numbers originates. Thus, the following is argued: 1) the emissions from CFCs and HCFCs should be included in the Inventory and 2) fluorocarbon emissions (CFCs, HCFCs, and HFCs) are undercounted across the board, particularly when factoring in reclaim rates, equipment sales, and leak rates. The former shall be explained with a case example of HCFC-22 usage; the latter shall be explained with an overview of market consumption.

First, Section 4.13 of the Inventory details HCFC-22 Production in the United States, particularly the emissions of its byproduct, HFC-23. In fact, it states, "In 2008 and 2009, U.S. production declined markedly and has remained near 2009 levels since." It goes on to describe a "long-term decrease in the [HFC-23] emission rate" and explains that this is in large part due to the decline in production of HCFC-22. However, principally, a decline in production does not equate to a decline in market demand (as evidenced by the stockpiles consumed amid the phaseout). Nowhere in this Section 4.13 is there a mention of a decline in market demand of HCFC-22. In the Final Rule for HCFC Allowances in 2015-2019 published in October 2014, the EPA

concluded "that there is still significant servicing need for HCFC-22."[1] Yet, the consumption of HCFC-22—which is millions of pounds annually—for servicing equipment currently in use has been disregarded in the Inventory. What ends are achieved by doing this? The fact that this particular fluorocarbon refrigerant, HCFC-22, is under a phaseout is secondary, what is primary and most important is the fact that this refrigerant is one of the most commonly used refrigerant and also has a very high GWP that of 1,760. When you take the widespread use of this refrigerant and its high-GWP coupled with the national leak rate average of 25%, that translates to significant emissions into the atmosphere, not to mention reclaim rates of R-22 have been less than expected and recent news reports of a possible impending R-22 shortage (i.e., supply-demand imbalance) indicate significant venting of R-22 has occurred. This case example with R-22 is not an anomaly but rather a symptom of the much larger problem: The undercounting of fluorocarbon emissions.

Additionally, if we look to Section 4.23, the problem only enlarges. Specifically, the Section states that 168.6 MT Co2e was emitted from HFCs and PFCs in 2015, and it was the refrigeration and air-conditioning sector that "contributed the most towards emissions of HFCs and PFCs … in 2015 (144.9 MMT CO2e, or approximately 86 percent)." While this number (i.e., 144.9 MMT CO2e from refrigeration and air conditioning) is much too low (and this will be explained momentarily), it should be noted that it does go on to state that "these refrigerants are emitted to the atmosphere during equipment manufacture and operation (as a result of component failure, leaks, and purges), as well as at servicing and disposal event." Thus, HFC emissions from usage and servicing—not just manufacturing (as with HCFC emissions discussed in the preceding paragraph)—are acknowledged. However, despite this acknowledgement, there is still an underreporting of HFC emissions in regards to refrigeration and air-conditioning (144.9 MT CO2e) occurring, which, of course, translates into the HFC and PFC total emission number of 168.6 MT CO2e being too low as well. Let me explain further.

As stated previously, in 2015, approximately 462 million pounds of fluorocarbon refrigerants were consumed in the United States.[2] This consumption number for 2015 alone indicates that the emissions are much more than what is reflected in the Inventory. For instance, take this approximation: Essentially, we have 462 million pounds of refrigerant, attributed to HFCs and HCFCs. Assuming a 1 to 1 correlation between pounds and MMT CO2e, we have an estimated 462 million MT CO2e. Now, 18 million MT CO2e of R-22 was allocated for 2015.[3] By deducting 18 million MT CO2e of R-22 from 462 million MT CO2e, that leaves 444 million MT CO2e. So, in sum, the assumption is 444 million MT CO2e from supply and market activity. Now, let's deduct the following from that number: 145 million MT CO2e for HFC emissions from the Inventory report; 32 million MT Co2e for installation into new equipment (i.e., using a

[1] 79 FR 64253 (October 2014). https://www.federalregister.gov/documents/2014/10/28/2014-25374/protection-of-stratospheric-ozone-adjustments-to-the-allowance-system-for-controlling-hcfc

[2] MarketsandMarkets. *Refrigerants Market: Global Trends & Forecasts to 2020.* www.marketsandmarkets.com

[3] 79 FR 64253 (October 2014). https://www.federalregister.gov/documents/2014/10/28/2014-25374/protection-of-stratospheric-ozone-adjustments-to-the-allowance-system-for-controlling-hcfc

7% growth rate, which is higher than the actual 4% growth rate in 2015[4]), 3 million MT CO2e for destruction, 0 for reclaim (although 10 million pounds recovered, it is assumed they were resold and vented[5]), and the 18 million MT CO2e for HCFCs/CFCs. Once these deductions have been subtracted from the 444 million MT CO2e, that leaves 246 million MT CO2e unaccounted for—This is the discrepancy. If we add this 246 number to the approximate 145 million MT CO2e found in Table 4-96 of Section 4.23, we get 391 million MT CO2e—In other words, that's our determination of the approximate amount being vented into the atmosphere for 2015 alone. That's staggering (and we haven't even included any assumptions about those numbers in regards to stockpiles). Accordingly, we estimate that for the years 1990 through 2015 nearly 8 billion pounds of F-gas have been vented into the atmosphere.

However, the emissions reporting found in the Inventory is not based on venting but rather on a complex tailing report to 65 critical use paths for F-gas, which is essentially demand reporting. Here's the crux: What does it matter if we consume 462 million pounds of fluorocarbon refrigerants, if there is only one end life: venting? As an illustration, only 1% of all fluorocarbon refrigerants are properly destructed at the end of their lives; the other 99% end up vented into the atmosphere, as there is no destruction requirement for these compounds. With this in mind, it's important to point out: Demand reporting is in conflict with traditional EPA controls. For good reason, EPA doesn't have resources to adequately capture the complex nature of inventory movements in each vertical of consumption space. So naturally, if EPA is using supply controls to manage F-gas phaseout, then we should follow the same path in reporting. That means accounting for consumption through service deployment, through leak emissions and then replacement, etc. Consequently, further research needs to be conducted to determine the actual values of F-gas inventory from a supply perspective—not a demand perspective—so that the EPA can reasonably and accurately calculate it without having to survey industries for their consumption. Importantly, there is one major indication that service ultimately leads to venting: the case of SF6 reporting through the EPA's own Facility Level Information on GreenHouse gases Tool (FLIGHT).[6] Indeed, consumer emissions from SF6 are reported. Therefore, we see and document SF6 usage and their emissions value, but we have no such value for all F-gas refrigerants currently. So, to reiterate, the 391 million MT CO2e of F-gas vented in 2015 is off-the-books. And think of this: if we were to include SF6 emissions into our approximation of the total amount of F-gas vented, that 391 million MT CO2e number would only increase.

As shown above, F-gas emissions are grossly undercounted for, and unless the described reporting issues are addressed and rectified, we will most likely, and unfortunately, continue on this same path: Venting millions of pounds of F-gas without any visibility to the real impact that it has to the bottom line for carbon accounting.

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[4] AHRI. "December 2015 U.S. Heating and Cooling Equipment Shipment Data." http://www.ahrinet.org/App_Content/ahri/files/Statistics/Monthly%20Shipments/2015/December_2015.pdf

[5] EPA. "Summary of Refrigerant Reclamation 2000-2015." https://www.epa.gov/sites/production/files/2017-01/documents/summary_of_refrigerant_reclaimed_2000-2015_1.pdf

[6] EPA. "Facility Level GHG Emissions Data." https://ghgdata.epa.gov/

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