The Sierra Club and EarthJustice submitted two papers to the Office of Management and Budget as a part of their October 27, 2023, meeting. The two papers were a PFAS incineration memo and a published paper on soil concentrations of PFAS compounds around the hazardous waste incinerator in East Liverpool, Ohio. Both contain inaccuracies and misleading statements that the Coalition for Responsible Waste Incineration (CRWI) would like to point out.

PFAS incineration memo

1. Lack of data

   In the first line of the memo, the authors state that "Incineration is not proven to safely destroy per- and polyfluoroalkyl substances (PFAS). Commercial incinerators do not, and often cannot, measure their PFAS releases, and the limited laboratory testing that has been conducted does not reflect real-world incineration conditions."

   This statement is not correct. EPA and the Department of Defense (DoD) have conducted extensive research showing that the initial PFAS compounds can be destroyed under certain conditions and that products of incomplete destruction (PID) can be minimized. Chemours has data on PFAS destruction that has been shared with the Agency. Clean Harbors conducted a test at their Aragonite facility showing 99.9999% destruction of the original compounds. The Clean Harbor data can be found at https://www.cleanharbors.com/PFAS-Study. These data have also been shared with the Agency. OTM-45 can measure stack gas emissions for polar, semi-volatile PFAS compounds and OTM-50 will be able to measure volatile PFAS compounds.

   In the first paragraph of page 1, the memo states "despite an acknowledged lack of data." This statement ignores data that EPA has posted its PFAS Thermal Treatment database (https://pfastt.epa.gov/ords/pfastt/f?p=178:1::::::) which "contains over 2,000 records of 80 sources documenting the treatability of PFAS in different media via various thermal processes." It ignores the peer-reviewed papers published by EPA on the subject and several additional presentations made by Agency personnel at conferences on the subject. It also ignores the considerable amount of research that has been and is being carried out by the Department of Defense. The DoD website (https://serdp-estcp.org/focusareas/deb5c156-f647-4934-8313-fa00364ff55e/treatment-of-pfas-impacted-matrices) lists 140 research projects on the destruction of PFAS containing materials. Some of these projects are thermal related while others look at alternative technologies to destroy PFAS compounds. While the final reports for a number of these projects have not been released, several have plus the DoD and EPA have been sharing data from these projects prior to release to the public. Finally, EPA has access to the Clean Harbors Aragonite test data and test data from Chemours in North Carolina and West Virginia. Hopefully, these data will be incorporated into the current revision of the guidance.

In paragraph #2, page 6, the first sentence states “There is no evidence that any incinerator operating in the United States can safely destroy concentrated PFAS waste such as AFFF.” This sentence is not correct. The Clean Harbors Aragonite data proves that a commercial unit can destroy aqueous film-forming foam (AFFF) waste.

2. The Sierra Club memo states that “Thermal breakdown of PFAS can form a range of harmful breakdown products.”

   There are several statements in this section that are misleading. No data was provided to support the statement that incineration units are depositing harmful breakdown products from the destruction of PFAS waste or any hazardous wastes. In fact, hazardous waste incineration units have passed Human Health Risk Assessments as part of their RCRA permitting process which demonstrate that the risks from emissions are within scientifically established acceptable acute and chronic levels of exposure. In addition, this process is overseen by EPA and authorized state agencies.

   The paper includes dioxins and furans in this section. This is misleading. Dioxins and furans are chlorinated organics – not fluorinated organics. Combusting fluorinated compounds has nothing to do with dioxins.

   The paper also compares PFAS with PCBs. EPA’s website (https://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas) shows final toxicity assessments for six PFAS compounds. The toxicity data EPA has is for longer chain PFAS compounds which EPA, Chemours, and Clean Harbors data have shown can be destroyed with a properly operated hazardous waste incinerator. Some shorter chains PFAS compounds show no toxic effects. The two most mentioned short chain PFAS compounds are CF4 and C2F6. C2F6 is used during eye surgery (https://pubmed.ncbi.nlm.nih.gov/1463412/). The Safety Data Sheet for CF4 (https://www.airgas.com/msds/001051.pdf) states under inhalation risk “No known significant effects or critical hazards.” It is not appropriate to lump the entire chemical group is this comparison.

   The last sentence in the first paragraph of page 4 states “These findings are not reflective of actual incineration conditions, and they have not been replicated at an operational scale.” This is incorrect. Chemours and Clean Harbors proved on an operational scale that PFAS can be destroyed in a combustion unit.

3. Promising technologies

   The Sierra Club / Earthjustice paper states:

> *"Among the most promising technologies are Super Critical Water Oxidation (SCWO) which EPA has said appears to be a promising alternative to incineration for AFFF waste."*

To date, SCWO does not have an established track record of reliably and routinely achieving a 99.99% destruction and removal efficiency (DRE) of the primary products under controlled, scientific testing conditions. In short, the availability of studies demonstrating that SCWO can achieve sufficient DRE on a reproducible basis and not generate PIDs at levels of concern, is minimal at best, when compared to what exists for hazardous waste incinerators. As such, it is premature for the Sierra Club and Earthjustice to argue that SCWO is a "promising PFAS destruction technology."

4. Acid gas scrubbing

In the fourth paragraph on page 5, the memo talks about hydrogen fluoride (HF). The memo is correct in that HF is highly corrosive. What is not mentioned is that HF is easier to scrub from the air than is hydrogen chloride. The effectiveness of a wet scrubbing control method to remove acid gases from a combustion gas air stream is dictated by the solubility in water of each acid gas. The CRC Handbook, 56$^{th}$ Edition lists the solubility of hydrogen chloride as 82.3 g/100 cc in cold water and as 56.1 g/100 cc in hot water and hydrogen fluoride is listed as infinitely soluble in cold water and very soluble in hot water. Hydrogen fluoride is therefore more soluble in water than is hydrogen chloride. Thus, a facility that has been designed to use wet scrubbing to control hydrogen chloride will also effectively control hydrogen fluoride. The operating limits established during a comprehensive performance test for control of hydrogen chloride will also effectively control hydrogen fluoride emissions. EPA recognized this in the 2010 proposed boiler rule (75 FR 32,006, June 4) where in Footnote 16 the Agency stated "HCl can serve as a surrogate for the other acid gases in a technology-based MACT standard, because the control technology that would be used to control HCl would also reduce the other acid gases." In response to comments that HCl was not a good surrogate, EPA responded as follows.

> "The acid-gas HAP (HCl, HF, HCN and Cl2) are expected to be removed using technologies that take advantage of their solubility or their acidity (or both). This will likely be done using technologies that are often used for control of SO2 or SO3 (also acidic gases). Because it is highly likely that facilities will choose to control these acid gases by applying the same technology and the means of removal for each are similar, it is logical to select one (HCl) as a surrogate to represent the control of the others."

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Based on fundamental principles, a hazardous waste incinerator that has a wet scrubber and is meeting its hydrogen chloride limits will also be effectively controlling

hydrogen fluoride emissions. Clean Harbors demonstrated this during their Aragonite test cited above.

5. On pages 6-8, the memo cites a number of "exceedances" for four hazardous waste incinerator facilities. This information is misleading. For example, the Clean Harbors Kimball facility is a significant RCRA non-complier only because the state and EPA take years to finalize an inspection. The facility corrected all of the issues identified same day of the inspection or within a week if something needs to be purchased (i.e., a sign). The state and EPA have been given this information but have not closed the inspection report.

6. Paper on the soil concentrations of PFAS around East Liverpool

   The paper from Martin, et. al., was also submitted to the docket as evidence that the hazardous waste incinerator in East Liverpool, OH was contributing to the PFAS soil concentrations around the facility. In the conclusions, the paper states:

   > ". . . we cannot directly link the observed PFAS levels in our study to the hazardous waste incinerator."
   >
   > "We detected even higher PFOS concentrations at 7 of our sampling locations. . . Interestingly, each of these sites is upwind of the incinerator making it unlikely to have stemmed from the incinerator."