MEMBER COMPANIES

Clean Harbors Environmental Services
Eastman Chemical Company
Heritage Thermal Services
INV Nylon Chemicals Americas, LLC
Ross Incineration Services, Inc.
The Dow Chemical Company
Veolia ES Technical Solutions, LLC

GENERATOR MEMBERS

Eli Lilly and Company
Formosa Plastics Corporation, USA
3M

ASSOCIATE MEMBERS

AECOM
Alliance Source Testing LLC
B3 Systems
Civil & Environmental Consultants, Inc.
Coterie Environmental, LLC
Eurofins TestAmerica
Focus Environmental, Inc.
Franklin Engineering Group, Inc.
Montrose Environmental Group, Inc.
Ramboll
Spectrum Environmental Solutions LLC
Strata-G, LLC
SYA/Trinity Consultants
TEConsulting, LLC
TRC Environmental Corporation
Wood, PLC

INDIVIDUAL MEMBERS

Ronald E. Bastian, PE
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ACADEMIC MEMBERS
(Includes faculty from:)

Clarkson University
Colorado School of Mines
Lamar University
Louisiana State University
Mississippi State University
New Jersey Institute of Technology
University of California – Berkeley
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August 29, 2022

Office of Science and Technology Policy
RFI Response: PFAS Strategic Plan

Submitted via email

The Coalition for Responsible Waste Incineration (CRWI) appreciates the opportunity to submit a response to the *Request for Information; Identifying Critical Data Gaps and Needs to Inform Federal Strategic Plan for PFAS Research and Development*; Notice of Request for Information. 87 FR 41,749 (July 13, 2022). CRWI is a trade association comprised of 26 members representing companies that own and operate hazardous waste combustors and companies that provide equipment and services to the combustion industry.

General comments

CRWI supports the development of a government-wide strategic plan to address the issues associated with PFAS contamination and cleanup. This is a problem that transcends all government agencies and a consistent plan should be developed. CRWI's expertise is in the destruction of organic chemicals through the use of high-temperature combustion. Our members have been successfully destroying organic chemicals since the 1980's. CRWI members have been destroyed fluorinated organic compounds (ozone depleting substances) for decades under the Montreal Protocol and are required to demonstrate effective destruction for those compounds. While ozone depleting compounds are not considered to be PFAS under the current definitions, both sets of compounds have carbon-fluorine bonds. The destruction of organic chemicals in our industry are regulate under 40 CFR Part 63, Subpart EEE. All of our members must comply with these regulations or cease operations. We will focus our comments on the destruction methods and how that destruction is measured.

There is currently only one commercially available method for destroying PFAS compounds – high temperature incineration. There are other methods that have shown promise but to date, these methods do not achieve the same destruction efficiency as incineration or they are still in pilot or demonstration scale. All destruction technologies have the same issues with measurement methods and products of incomplete destruction.

In the request for information, the Office of Science and Technology Policy asked for specific responses to nine questions. Below are our responses to all or parts of three questions that are associated with destruction and the ability to measure emissions. We have used the question numbers from the *Federal Register* notice to make it easier to know where each comment is directed.

Background

Before we actually respond to the questions, some background information on how the hazardous waste combustion industry already performs their requirements will make the responses easier to understand.

Hazardous waste combustors have been using performance testing and continuous monitoring to show compliance with RCRA and Clean Air Act requirements since the 1980's. This process was developed under RCRA and refined under the Clean Air Act Amendments of 1990. A performance test includes a method to demonstrate destruction of the original organic compounds. This method is a destruction and removal efficiency (DRE) test as required in 40 CFR 63.1219(c). To make this demonstration, the facility must conduct a test proving they can destroy at least 99.99% of an organic compound that is more difficult to destroy than the compounds they would normally combust. In the process of conducting that test, operating parameter limits are established so the facility can demonstrate continuous compliance. This concept was developed early in the regulation of hazardous waste incinerators under Subpart O of RCRA. In the guidance document for hazardous waste incinerators,[1] EPA discusses the concepts for demonstrating DRE for organic hazardous waste. In the opening paragraphs of this guidance document, EPA explains this concept.

> "The Subpart O regulations require that POHC's (Principal Organic Hazardous Constituents) be designated for each waste feed. The required DRE must then be demonstrated for the POHC's during the trial burn. Since the POHC's must be representative of the waste feed, they are chosen on factors such as difficulty to incinerate and concentration in the waste feed. The operator is then limited in the permit to burning only waste containing hazardous constituents no more difficult to incinerate than the POHC's for which compliance was demonstrated during the trial burn."

This guidance gives detailed instructions on selecting POHCs and the entire process of demonstrating DRE. Hazardous waste combustion facilities have used this guidance since 1989 to demonstrate the ability to meet these criteria. Appendix VIII of the guidance contains a list of organic compounds ranked on how difficult they are to destroy (incinerability index). This approach was initially developed by researchers at the University of Dayton.[2] Class 1 chemicals on this list are the most difficult to destroy.

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[1] *Guidance on Setting Permit Conditions and Reporting Trial Burn Results*. Volume II of the Hazardous Waste Incineration Guidance Series, January 1989, EPA/625/6-89/019

[2] Dellinger, B. and D. L. Hall. 1986. *The Viability of Using Surrogate Compounds for Monitoring the Effectiveness of Incineration Systems*. Journal of the Air Pollution Control Association, 36:179-183

For example, chlorobenzene is a Class 1 chemical. When a facility demonstrates a minimum DRE of 99.99% for chlorobenzene, it is inferred that the facility can destroy a similar or greater percentage of any organic chemical ranked lower in Class 1 or any chemical in Classes 2 through 7.

Thus, the method for demonstrating the destruction of organic compounds is to conduct a test where the facility selects one or more POHCs that is at least as difficult to destroy as the constituents in waste feed and prove at least 99.99% destruction and removal efficiency of those POHCs. In the process of conducting a successful DRE test, the facility sets the operating limits that are used to demonstrate continuous compliance with the DRE requirement. Facilities are only allowed to operate when they meet the operating limits as defined by their latest test results. Once the facility has successfully completed these tests, they not only show more than 99.99% destruction and removal but set the operating parameters to show they can accomplish this on a continuous basis.

Response to specific questions

3. What are the scientific, technological, and human challenges that must be addressed to understand and to significantly reduce the environmental and human impacts of PFAS and to identify cost-effective methods to safely destroy or degrade PFAS?

   CRWI believes that high temperature combustion has already been shown to be able to destroy a subset of the most common PFAS compounds. This has been demonstrated at a large-scale facility by test results from Chemours, Clean Harbors, and a Department of Defense sponsored project at TD*X (additional information available upon request). In addition, there have been published studies under laboratory settings showing 99.99+% destruction from both industry and EPA (discussed below). There are three main data gaps that need to be addressed in developing a strategic plan for thermal destruction of PFAS compounds. These are:

   - Determining where PFAS compounds fit into the incinerabiity index;
   - Development of standardized methods to measure PFAS emissions during testing; and
   - Development of standardized methods to identify and measure products of incomplete destruction.

   Incinerability index. At this point in time, there are no PFAS compounds listed in the incinerability index. There are fluorinated organic compounds (mostly ozone depleting compounds) in the index but none fit the current definition of PFAS. There have been a limited number of studies that indicate where certain PFAS wastes fit within this index. In 2001, 3M commissioned a series of tests on the thermal degradation of perfluorooctanesulfonic acid (PFOS) and two C8 perfluorosulfonamides (FC-1395 and FC-807A). The report was issued in 2003 and

submitted to EPA's docket.[3] In the report, University of Dayton researchers demonstrated approximately 99.95% destruction of PFOS and the two C8 perfluorosulfonamides at 900 °C with a 2 second residence time. Two studies were commissioned by DuPont. In the first,[4] DuPont wanted to know if paper and textiles treated with fluorotelemer-based acrylic polymers would release perfluorooctanoic acid (PFOA) when combusted under conditions found in a typical municipal incinerator. In this study, University of Dayton researchers determined that the temperature at which 99.9% of the polymers were destroyed was 1000 °C (with a 2 second residence time). For the paper and fabric coated with the polymers, 99.9% of the PFAS compounds were destroyed at 750 °C (with a 2 second residence time). In the second DuPont study,[5] University of Dayton researchers confirmed and extended the findings of the 2005 study. It should be noted that the purpose of the studies mentioned above was to show relative destruction under defined process conditions for the purpose of ranking these compounds in the incinerability index. These numbers should not be confused with a 99.99% DRE requirement under Subpart EEE.

The Department of Defense and EPA have recently funded a study at the University of Dayton to at least partially confirm where PFAS compounds fit within the incinerability index. These two Federal Agencies should be encouraged to complete these studies and release the results. This additional information is necessary to determine where the PFAS compounds being studied fit into the existing incinerability ranking.

Stack gas measurement methods. EPA has released one method for measuring certain PFAS compounds in stack gases (OTM-45). It was released as an Other Test Method (OTM). In the opening paragraph, the Agency states that posting this method is "neither an endorsement by EPA regarding the validity of the test method nor a regulatory approval of the test method." OTM-45 is designed to measure emissions of 50 semi-volatile compounds. It is our understanding that EPA will release another OTM for volatile compounds in late 2022. An OTM is not a standard method. Without a standard test method to measure PFAS emissions from stack gases, facilities cannot demonstrate during a test that they are achieving a given level of destruction or would meet potential regulatory requirements. One of the highest priorities for the government should be to develop standardized methods for measuring PFAS compounds in stack gases.

Products of incomplete destruction. The same measurement problems exist when attempting to quantify PFAS products of incomplete destruction. This issue applies equally to all existing and proposed destruction methods. Until a standard method

[3] EPA-HQ-OPPT-2003-0012-0151
[4] Yamada, T., P. Taylor, R. Buck, M. Kaiser, and R. Giraud. 2005. *Thermal degradation of fluorotelemer treated articles and related materials*. Chemosphere. 61:974-984.
[5] Taylor, P., T. Yamada, R. Striebich, J. Graham, and R. Giraud. 2014. *Investigation of waste incineration of fluorotelomer-based polymers as a potential source of PFOA in the environment*. Chemosphere 110:17-22.

for measuring all PFAS compounds of interest is available, it is not possible to demonstrate that air emissions from these destruction methods are below levels of concern.

6. What should be the research and development priorities for accelerating progress, improving efficiency, and reducing the cost of analytical methods, detection limits, non-targeted detection?

   CRWI believes that the primary research and development priorities should be to determine the following information:

   - What specific POHCs should be used to demonstrate that a facility can destroy PFAS containing wastes;
   - Where selected PFAS compounds fit into the incinerability index; and
   - What methods should be used to measure the PFAS compounds and fluorinated products of incomplete destruction of interest.

   With this information, all treatment facilities will be able to use the DRE process to demonstrate destruction of the PFAS compounds in question as well as accurately determining whether there are any fluorinated products of incomplete destruction.

9. What goals, priorities, and performance metrics would be valuable in measuring the success of national, federally funded PFAS research and development initiatives relating to safely destroying or degrading PFAS.

   The performance metrics for the destruction of fluorinated organic compounds should be the same for all destruction methods regardless of the technology deployed. This should include a quantification of four items:

   - The destruction of the original compound;
   - The emissions to the air;
   - The amount of PFAS remaining in the residuals from the treatment process; and
   - The products of incomplete destruction.

   All destruction methods must be judged by the same performance metrics. It is important to note that different treatment methods will likely be needed for different circumstances. For example, the destruction technologies for a very high volume wastes at very low PFAS concentration, as would be the case for wastewaters, will be very different from the technology needed for destroying concentrated aqueous film-forming foam. However, all destruction methods should have the same performance metrics and the chosen technology should be based on a combination of destruction efficiency and minimizing the releases to the environment.

No one treatment method is the “best” under all circumstances. The government should continue to research and develop other methods, especially for those circumstances where high temperature combustion is not optimal.