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January 22, 2024

Mr. Sean Smith, M.S.
Product Replacement Program Manager
Washington Department of Ecology
Northwest Regional Office
PO Box 330316
Shoreline, WA 98133-9716

Submitted online via ecology.wa.gov/AFFF-comment.

Re: Draft AFFF Environmental Impact Statement

Dear Mr. Smith,

Washington Department of Ecology has presented a comprehensive preparation of the Draft EIS document. After a review of the draft document several comments are appropriate that may contribute to the continuing evaluation of the five listed alternatives and selection of the most appropriate one.

On behalf of Clean Harbors Environmental Services, Inc. these comments are submitted to clarify several sections of the draft EIS.

Products of Incomplete Combustion

The draft EIS did not include reference to a recent test EPA performed at the Raleigh NC facility “rainbow furnace”. AFFF was injected into the furnace at multiple temperatures and stack gas samples were analyzed using an OTM-50 methodology. EPA was able to confirm > 99.999% destruction but also confirmed that products of incomplete combustion was virtually zero when temperatures above 1090°C were used.

Section 1.5.1.3 – National Defense Authorization Act

The Clean Harbors PFAS Destruction test at the Aragonite UT facility was shared with both EPA and DoD. EPA did not have that data when the initial PFAS disposal guidance was developed but both agencies got it shortly after that publication.

Section 2.1.5.10 – Dangerous Waste Transport, Treatment and Disposal Facilities Contracted with Washington Department of Ecology



The Clean Harbors section includes information from a PFAS Destruction Test performed in 2021. That report was shared with several state and federal agencies including EPA, DoD, and the Department of Ecology. In addition to determining destruction removal efficiency, stack emissions were sampled and analyzed using EPA OTM-45. That data was run through EPA risk modeling and the results were 5-8 orders of magnitude below any state or federal air ambient limit/guideline in effect at the time. This risk assessment is the same required under RCRA for hazardous waste combustors.

The report and data were peer reviewed by Dr. Phil Taylor, a recognized incineration expert who has worked on PFAS destruction for decades. Dr. Taylor confirmed the destruction study was professionally designed and executed.

Section 3.1.4 – Data Gaps

As noted above, the PFAS destruction test was peer reviewed by Dr. Phil Taylor.

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Both the Aragonite UT and Kimball NE facilities have zero water discharge operations. All waste is managed in RCRA permitted containment to prevent any release to the environment.

Table 3.11-4 – Relative Risk Associated with Alternative 2 by Resource

The human health & safety impacts column does not mention the risk assessment modeling performed. This confirmed stack emissions are protective of human health.

Clean Harbors Environmental Services (CHES) elected to conduct its first full-scale testing of PFAS destruction at its HWC in Aragonite, Utah. The Team of EA Engineering, Science, and Technology, Inc. and Montrose Environmental Group, Inc. was retained by CHES to develop a comprehensive program for PFAS destruction testing at Aragonite, to conduct the testing and to report the results, under technical oversight by Focus Environmental, Inc. The testing was conducted June 2021 and included sampling and analysis for forty-nine target PFAS analytes in HWC process waste feed streams, treatment chemical feed streams, solid and liquid process residue streams, and HWC stack gases.

Three sets of waste feed conditions were evaluated by running triplicate tests under each condition.



1. Test Condition 1 was intended to establish a baseline, by feeding a typical waste profile, without adding additional PFAS spiking compounds to the waste feed (Test Runs 1 - 3).
2. During Test Condition 2 (Test Runs 4 - 6), the feed rates of perfluorooctanoic acid (PFOA) (CAS# 335-67-1), perfluorooctanesulfonic acid (PFOS) (CAS# 1763-23-1), perfluorohexane sulfonic acid (PFHxS) (CAS# 355-46-4), and hexafluoropropylene oxide – dimer acid (HFPO-DA or GenX) (CAS# 13252-13-6) were augmented by spiking to facilitate calculation of destruction and removal efficiency (DRE) values for these compounds.
3. During Test Condition 3 (Test Runs 7 - 9), aqueous film forming foam (AFFF) concentrate was also fed to the HWC.

U.S. Environmental Protection Agency Other Test Method 45 (OTM-45) was employed for sampling stack gas during the testing. The PFAS analytical method employed for this test program was Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) with Department of Defense Isotope Dilution for the forty-nine targeted PFAS analytes. U.S. Environmental Protection Agency Method 26A was employed for determination of hydrogen fluoride (HF) concentration in stack gas.

The results of the June 2021 testing demonstrate that common legacy PFAS (perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), and hexafluoropropylene oxide – dimer acid (HFPO-DA or GenX) are **effectively destroyed in the Aragonite incineration system at levels exceeding 99.9999 percent (%) DRE**. This was demonstrated during all three test runs (Test Runs 4–6) when spiking was conducted. It should be noted that RCRA and TSCA regulations require a 99.9999% DRE be demonstrated to destroy dioxins and polychlorinated biphenyls (PCB's).

In all cases DRE values were calculated using the most conservative approach. Analytes that were not detected in the feed materials were included as zero values in the waste feed material mass balance. PFAS contributions from treatment chemicals were not included in the DRE calculations (per Resource Conservation and Recovery Act (RCRA) regulations).

Analytes that were not detected in the stack gas samples were assumed to be present at the method detection limit (MDL) in the mass balance. Because of these various conservative assumptions, it is likely that all the actual DREs are greater than the values presented in this report.

Stack gas concentrations for all forty-nine target PFAS analytes were either not detectable, or if detectable results were near the limit of quantitation. The individual PFAS stack gas mass emission rates were extremely low, ranging from 10^{-9} to 10^{-7} pounds per hour (lb./hr.), with an aggregate stack emission rate for all target PFAS on the order of 10^{-6} lb./hr. **Stack gas**



emissions were modeled using EPA's AERMOD program and were 5 to 8 orders of magnitude lower than any state or federal ambient air quality guideline if effect.

The Aragonite HWC is a zero-water discharge facility and all solids generated are sent to a RCRA hazardous waste landfill for secure disposal.

In summary, the test data supports RCRA permitted high temperature thermal destruction units can effectively destroy PFAS chemicals. Stack gas emissions were modeled using EPA methodology and are 5-8 orders of magnitude below any state or federal ambient air quality guideline if effect.

We appreciate the opportunity to provide comments.

Sincerely,

A handwritten signature in black ink that reads "Michael Crisenbery". The signature is written in a cursive, flowing style.

Michael Crisenbery, CHMM
SVP, Facilities Compliance and Government Affairs
Clean Harbors Environmental Services, Inc.