EPA Interim Guidance on the Destruction and Disposal of PFAS

[Last updated: May 2026]

Framework for Evaluating Destruction Technologies for PFAS-Containing Materials: Hydrothermal Alkaline Treatment (HALT)		
Category of Information	**Key Questions**	**Answer**
Technology	If available, what is the TRL for the technology/material combination of interest?	HALT is at a TRL 8 across a variety of concentrated PFAS matrices. Its effectiveness has been field-tested at over a dozen industrial and U.S. government-funded demonstrations since 2023. The first permanent commercial installations will be delivered to customers in the US and Europe in 2026 and 2027.
	Is the technology of interest available at the scale needed for the intended application?	Yes. Three HALT system sizes are available for order now. Current delivery schedules range between 6 and 12 months from the date of order. Our largest full-scale system, the Stampede series HALT, has a continuous flow capacity of 1 gallon per minute. This system will be used to process AFFF concentrate and other PFAS liquid wastes at a centralized facility in Colorado, starting in 2027.
	Is a treatment train needed to meet the desired destruction/disposal outcome?	Yes, in most cases HALT fits into a treatment train that involves separation and concentration steps, filtration of suspended solids, and alkaline amendment. Effluent from HALT is typically neutralized and lightly polished with adsorptive media before discharge. Recirculation into the overall PFAS treatment train is also a proven method improving performance of capture technologies and reducing operational costs.
Material	What PFAS-containing material has been used to test the performance of the technology of interest?	HALT has been used to destroy PFAS in a variety of industrial wastewater types, including complex (high-salt and co-solvent) industrial waste streams with TFA and other short- and ultrashort-chain PFAS; AFFF concentrate; AFFF-impacted surface water and groundwater; and landfill leachate. HALT is suitable for residuals from PFAS concentration technologies, such as foam fractionate with a variety of foaming boosters, regeneration brines from ion-exchange resins, reverse osmosis reject streams, and regeneration solutions from novel sorbents.
	Which PFAS, and at what concentration ranges, have been used to test the performance of the technology of interest?	HALT can achieve >99.9% destruction of known PFAS types. Concentrations range from 50,000 ng/L to 10+ g/L PFAS in AFFF and TFA waste streams. Aquagga works with clients to optimize the HALT conditions of temperature, pH, and flow rate for their specific PFAS matrices and destruction goals.
	Are there non-PFAS constituents that may affect the performance of the technology of interest?	HALT is generally resilient to common co-constituents in PFAS-impacted waste water, including TDS and COD. Suspended solids should be removed. Hard metals (Ca, Mg) can lead to scaling in HALT conditions. Automatic clean-in-place procedures mitigate this risk.
Analytical Methods	Which standardized or validated targeted analytical methods (e.g., OTM-45, EPA Method 1633A) have been used to	HALT has been rigorously tested using both targeted and non-targeted methods.

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Analytical Methods (continued)	characterize the performance of the technology for the PFAS-containing material of interest?	This includes EPA Method 1633, ultrashort-chain PFAS methods, total organofluorine methods (TF, TOF-CIC, AOF, EOF), gas phase methods (OTM-45, OTM-50, OTM-55), as well as inorganic fluoride methods (SM-4500F, FISE) and analyses of solid precipitates (XRD). Please refer to our list of publications and publicly available test reports.
	Has non-targeted analysis been performed on waste streams from the technology/material combination of interest? If so, are there other PFAS detected that should be considered when assessing this technology?	Both 19F-NMR and TOF-CIC have been applied to demonstrate that no other PFAS are detected via these approaches. View our 2024 publication and 2026 publication with the 3M Company.
	What other analytical approaches have been used to characterize the performance of the technology for the PFAS-containing material of interest?	Non-target PFAS analysis via LC-QToF-MS has been applied to PFAS concentrates before and after HALT treatment, finding >99% reductions in peak areas among all non-target PFAS classes identified in the matrix. Hydrothermal Alkaline Treatment for Destruction of Per- and Polyfluoroalkyl Substances in Aqueous Film-Forming Foam
	Was the study design and the quality of the data generated during testing appropriate to evaluate the technology?	Yes, extensive high-quality data has been generated in both benchtop academic studies and field studies on a real-world industrial matrix using a wide range of analytical methods. Academic Studies: Hydrothermal Alkaline Treatment (HALT) of Foam Fractionation Concentrate Derived from PFAS-Contaminated Groundwater Hydrothermal Destruction and Defluorination of Trifluoroacetic Acid (TFA) Rapid Destruction and Defluorination of Perfluorooctanesulfonate by Alkaline Hydrothermal Reaction Field Studies: Degradation and Defluorination of Ultra Short-, Short-, and Long-Chain PFASs in High Total Dissolved Solids Solutions by Hydrothermal Alkaline Treatment—Closing the Fluorine Mass Balance Demonstration of hydrothermal alkaline treatment for PFAS destruction in industrial wastewater: Assessment of degradation, defluorination, fluorine mass balance, and potential for volatile organofluorine formation The fluorine mass balance has been studied extensively for HALT to validate complete mineralization achieved during operation.
Destruction Efficacy	Is the mechanism of destruction understood?	Yes, HALT has been fully characterized, and the destruction kinetics are understood. Please refer to the papers above.
	Have all process inputs and outputs been characterized for PFAS to the extent possible given current analytical methods?	Yes.

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Destruction Efficacy (continued)	What is the reported destruction efficiency?	HALT can achieve >99.99% destruction across the range of target PFAS as well as total organofluorines. This has been proven in bench and pilot-scale demonstrations for a variety of matrices.
	Have any PIDs (or PICs) been identified?	1H-perfluoroalkanes can be produced under sub-optimal treatment conditions. Operation at temperatures above 300 °C mitigates this risk.
	Has a fluorine mass balance been determined?	Yes, HALT achieves near-100% fluorine mass balance, within the margin of analytical uncertainty. Please refer to the publications in the previous sections.
	Have all process outputs been characterized for non-PFAS constituents to the extent possible given current analytical methods and understanding of the composition of the PFAS-containing material?	Yes. We have characterized the fate of organics, metals, and other constituents in the HALT process. Dissolved salts and metals species remain unaffected by HALT processing, while organic co-constituent levels are often reduced via hydrothermal decomposition into simple products like CO_2 and methane. No harmful byproducts are generated from matrix co-constituents (e.g., perchlorate, bromate) during HALT processing.
Community Considerations	Has a destruction/disposal site been identified?	HALT systems are designed for on-site treatment at industrial facilities or remediation locations. These sites typically have existing wastewater treatment infrastructure and are expanding operations to include PFAS removal and destruction. HALT systems can be shipped globally for such purposes. Aquagga is establishing a permitted PFAS destruction site in Colorado for the implementation of CDPHE's PFAS destruction project for AFFF. A site has been identified and will be announced later in 2026.
	What are the characteristics of the surrounding community?	Please refer to the above answer.
	Are PFAS releases anticipated from the technology/material combination of interest?	No.
	Has the surrounding community been engaged?	Aquagga is active at industry and community events to educate people about HALT and the benefits of on-site PFAS destruction.
Regulatory Requirements	Are there state or federal regulations that control emissions or releases from the technology of interest?	Depending on the discharge plan for the liquid effluent from HALT, clients will need to comply with local industrial discharge requirements. Recirculating HALT effluent in a closed-loop process will eliminate the need for discharge permitting. There are no gas permitting requirements for HALT systems, as there is no exhaust point or stack.
	Are there state or federal regulations that control the management of the PFAS-containing material of interest?	Yes, federal, state, and local regulations drive the destruction targets and disposal options for HALT effluent.

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