National Defense Center for Energy and Environment

WASTEWATER EVAPORATORS AS AFFF MITIGATION STRATEGY AT FIREFIGHTING TRAINING FACILITIES

PROJECT OVERVIEW

The issues of perfluoro- and polyfluoroalkyl substances (PFAS) in aqueous film forming foam (AFFF) are exhaustively documented. The DoD apply restrictive policies such that any process effluent containing PFAS above the EPA drinking water recommendations are treated as hazardous waste. The firefighting research, test, and training operations at Tyndall Air Force Base contain and collect all effluent waste as well as rainwater captured in holding systems. Consequently, that entire volume is classified as hazardous waste and must be disposed appropriately. Combining operations and precipitation, the annual waste volume is ~750K to 1M gallons. The logistic and financial burden to manage and dispose that waste stream is enormous and approaches that effectively and responsibly reduce total volume have corresponding payback.

Thermal wastewater evaporation is a widely used, conventional means. to manage various waste streams such as mining and industrial processes. The vapor is released leaving a concentrated brine and reducing the hazardous waste volume. The process has not been examined and demonstrated for AFFF-waste streams. Three commercial evaporator platforms were purchased and operated during the project; two pilot-scale systems to develop and refine process and a larger scale system to manage waste volume at the operational site. The test plan was designed to determine efficiency and efficacy of thermal evaporation for the representative operational waste streams. Considerations included: total costs, evaporation rates, process issues (e.g., maintenance and pre-processing requirements), and vapor quality (co-vaporization of PFAS or other contaminants).

BENEFITS

The reduced volume of the hazardous waste stream is the straightforward benefit of thermal evaporation, dropping management costs accordingly. In addition, the onsite control and active management demonstrates proactive and responsible stewardship of operating sites and resources and control the fate of process effluent. The thermal evaporation hardware is readily available and may be tailored for a range of operation scales and may be integrated as a stage in a treatment sequence for firefighter training waste streams.

A. Untreated waste stream (Spring 2021)
B. Pilot scale pretreatment system
C. Evaporator Systems in operation (Winter 2021)

PATH FORWARD

Using solid-phase adsorptive media to pretreat the feedstock and then thermal evaporation, PFAS was concentrated on the media and in the evaporator brine. More than 1.3 M gallons of wastewater were processed, reducing hazardous waste to <2% of original volume. Analysis of the vapor effluent shows minimal fugitive PFAS. The operating costs–fuel, consumables, and waste disposal (e.g., concentrated effluent and materials)–were approximately $0.36 per gallon, compared to disposal costs of dilute aqueous wastes of $2.75 per gallon.

During the demonstration period a range of waste stream compositions and concentrations were addressed. The challenge exposed the importance of the pretreatment process. Early in the demonstration, the feedstock contained modest concentrations of contaminants, and once online, the system ran with few operator requirements. As the demonstration continued, the site test and training tempo had increased markedly; as the evaporator had eliminated much surplus, the new input had even less diluent. Accordingly, the system required more operator attentions. The surfactant in the PFAS-free fire suppression foams pose distinct challenges for processing. The issue will be addressed going forward and must be considered at any operational site that chooses to apply thermal evaporation practices.

The demonstration provides strategy to mitigate burdens due to AFFF-laden wastewater. The system provides a modular platform, amenable to ready installation and start-up. The final technical report will refine the transition (and scaling) of technology application to other DoD and civilian sites.

DoD Executive Agent

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FOR FURTHER INFORMATION

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