

### ZeroPM test site: Mytilene

Location: Greece, Lesvos Island



Previous studies have shown that PFAS is contaminating in the municipal wastewater and sewage sludge of Mytilene. Since 2012, over ten short-chain and long-chain perfluoroalkyl carboxylic acids (such as PFPeA, PFOA and PFTrDA) and perfluoroalkyl sulfonic acids (such as PFBS, PFOS and PFDS) have been systematically detected at concentrations of tens of nanograms per liter in wastewater and micrograms per kilogram in sludge.

Mytilene is a typical, medium-sized Mediterranean coastal city that is not heavily industrialized. The presence of PFAS in municipal wastewater originates from the daily activities of residents and tourists. The lack of removal of PFAS during water treatment means that contaminated wastewater and sewage sludge can contaminate the aquatic and terrestrial environment.

The local Sewage Treatment Plant (STP) uses an extended aeration activated sludge process with biological nitrogen and phosphorus in order to remove conventional pollutants such as BOD, COD, TSS, TN and TP. The excess secondary sludge is currently dewatered using a filter press and it is transferred to the landfill. There is no specific technical solution that is used to remove PFAS and other persistent and mobile substances from the wastewater and sludge. In addition, the activated sludge process results in the formation of some smaller PFAS due to biotransformation of precursors during wastewater treatment. Some of these smaller PFAS are then accumulated in the secondary sewage sludge.

ZeroPM will design an integrated prototype pilot plant system for sewage sludge treatment STP at the Mytilene STP test site. This system will combine biological and thermal processes for the mitigation and elimination of PFAS and other persistent and mobile substances with a parallel valorisation of the by-products. The pilot plant will include, in series, thermal or/and ultrasound sludge pretreatment, advanced anaerobic digestion, and sludge hydrothermal carbonization.

The pilot plant will be operated for two years receiving secondary treated sludge from different STPs around the island as well as biosolids from local food processing industries. The fate and the removal efficiency of target persistent and mobile substances will be studied, while the system will be monitored for its performance and energy requirements. The hydrochar which is produced as a by-product will be characterized and its potential future uses will be examined. An inventory of infrastructural inputs for the STP pilot upgrade will be noted and the operational inputs of chemicals and energy will be recorded. This information will provide a quantitative basis to evaluate the environmental sustainability of the tested processes using life cycle assessment. The outcomes of this assessment will be available to inform future infrastructure investment decisions.

If the technical solutions to be tested prove to be appropriate and sustainable, the Sewage Treatment Plant at the Mytilene site will be cleaner and the concentration of PFAS and other persistent and mobile substances reduced. This will protect human health and the environment from unwanted persistent and mobile substances.

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Activated sludge bioreactor for municipal wastewater treatment at the Mytilene STP



Secondary clarifier and administration building at the Mytilene STP



View of the filter press currently used at the Mytilene STP



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