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## **Halogenated Hydrocarbons Remediation With OSE II**

OSE II has had a long history of clean-ups with halogenated hydrocarbons, as this paper will discuss these, with focus on PFAS/PFOS due to our successful recent demonstration with an entity within the Australian Government. PFAS the chemical deemed the forever chemical, and the highly toxic PCB's found in old transformer oil have received allot of press and regulator discussions due to their persistence, and toxic properties.

Halogens are located as group 17 on the periodic table, of which there are 6. They consist of Chlorine, Bromine, Fluorine, Iodine, Astatine, and Tennessine. Tennessine acts as a halogen, but has metalloid characteristics as well. Our discussion will consist of, four of the six halogens, Chlorine, Bromine, Fluorine and Iodine. These halogens are highly reactive non-metals, since they have 7 electrons. Halogens can react with metals through ionic bonds, and react through covalent bonds with non-metals, especially hydrocarbons.

PFAS is Perfloralalkyl substances or Polyfloralalkyl substances, which are made of fluorine a halogen, and hydrocarbons. These are slow to breakdown due to the carbon-fluorine bond, which creates toxicity to environments. PFAS/PFOS is found in fire-fighting foam, used to make carpets stain resistant, cookware non-stick, to make food packing not stick to food, clothes and more.

PFAS/PFOS is found in waters, soil, and even absorbed into some concrete surfaces. To date, the only real way to clean water is through filtering which is costly, and potentially burning, however, this places adverse chemicals in the air, so it is rarely utilized.

OSE II has had a long history of remediating halogenated hydrocarbons, such as dichloralbenzene, TCE, PCE, PCB's, Perchloraethylene, and now PFAS. OSE II remediated halogenated hydrocarbons and these are the links to the testing, demonstration and or clean-ups.

1. PCB's for the US Air Force <https://www.osei.us/wp-content/uploads/Department-of-Air-Force-Power-Plant-Clean-Up.pdf>

2. Iran Transformer Research Institute Farsee. <https://www.osei.us/wp-content/uploads/Iran-PCB-transformer-company-test.pdf>

English <https://www.osei.us/wp-content/uploads/Iran-Transformer-Research-Institute-translated-English.pdf>

3. Alaska Key Bank Clean-Up of DichloralBenzene [https://www.osei.us/tech-library-pdfs/2011/16-OSEI%20Manual\\_ChlorHydroEfficacyTest.pdf](https://www.osei.us/tech-library-pdfs/2011/16-OSEI%20Manual_ChlorHydroEfficacyTest.pdf)

4. OSE II remediating PFAS on soil <https://www.osei.us/wp-content/uploads/PFAS.pdf>

**5. OSE II remediating PFAS on water meeting drinking water standards in Australia**

<https://www.osei.us/wp-content/uploads/PFAS-Contaminated-Water-Summary-And-Protocol-Australia-Second-PFAS-Test-Study-Demonstration-.docx-XXXX.docx-XXXXXXXZ.pdf>

**6. Pesticides can come under halogenated hydrocarbons as well, See link to pesticide testing,**

**<https://www.osei.us/wp-content/uploads/OSEI-Summary-for-Pesticides.pdf>**

7. The other chlorinated hydrocarbons mentioned are under NDA, and cannot be shown.

A group within the Australian government, (if you look at the test results of the PFAS it is disclosed) shared some of their PFAS contaminated soil, with certain requirement for testing. A third party was engaged in collecting the samples of soil/effluent from the aquariums, where the testing was carried out, protocol attached to the laboratory results.

The laboratory testing was determined and approved by the laboratory who worked closely with the Australian Government entity to ensure the test protocol was acceptable. The testing was carried out over 90 days, however the standard for clean-up was met in approximately 30 days.

One of the requirements of the Australian entity required with the testing was a description of the mode of action. The mode of OSE II that allows it to remediate halogenated hydrocarbons as well as hydrocarbons, starts with the ability of the biosurfactants combined with the multitude of enzymes, as well as additional proprietary aspects of OSE II developed during the manufacturing process, to partition and penetrate the molecules of a contaminant, where in the case of halogenated hydrocarbons, causes the oxidizing of the halogen/s, since it becomes in part a gas.

This also reduces the toxicity of the inorganic volume as well as the organic aspects of PFAS, hence allowing the colonization of indigenous bacteria to flourish and at some point, transition to the remaining PFAS/PFOS matrices, where it will become CO<sub>2</sub> and water. This has been the mode of OSE II actions for numerous halogenated hydrocarbon clean ups.

OSE II has been a part of other halogenated hydrocarbon sites, however due to NDA's we cannot discuss them with the public, the point is OSE II has had a history since 1991 of dealing with halogenated hydrocarbons.

This demonstrations/testing showed conclusively that OSE II remediates PFAS on soil and water, as was expected due to the past history of OSE II remediating halogenated hydrocarbons.

Steven Pedigo  
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