

PFAS CONTAMINANTS REDUCED TO NON-DETECT

CASE STUDY:

**PlumeStop Eliminates PFAS Risk at
Bulk Storage Facility in the Middle East**





Background

PFAS Groundwater Contamination in Saline Aquifer at Middle Eastern Bulk Storage Facility



Site consisted of a bulk storage facility with a commingled PHC and PFAS plume



The goal of remediation was to reduce all groundwater contaminants, therefore mitigating the risk to offsite receptors



A pilot study was developed to ensure feasibility to treat the affected aquifer

A bulk storage facility located in the Middle East region had a contamination release which resulted in a commingled groundwater plume consisting of petroleum hydrocarbons and Per and Polyfluoroalkyl Substances (PFAS) beneath the facility. The petroleum hydrocarbon contamination originated from historical facility operations and the PFAS contamination was the result of the use of aqueous film-forming foams (AFFF) during onsite fire training procedures. It was determined that remediation was required after it was assessed the underlying saline aquifer had likewise been contaminated and posed an imminent environmental risk to the surrounding area.

While the primary concern was PFAS contamination, a reduction in the chemical compounds benzene, toluene, ethylbenzene and xylene (BTEX) would likewise be required as part of further remedial action. The goal was to achieve mass reduction in all groundwater contaminants in order to mitigate the risk of contaminant migration to an offsite receptor.

InSitu Remediation Services Ltd. (IRSL) was engaged to develop a remediation approach for the contaminated site. IRSL has had prior success treating a similar mixture of contaminants at previous sites, using REGENESIS® PlumeStop® to sorb the contamination from the groundwater. IRSL worked alongside REGENESIS to design a pilot study to ensure the feasibility to treat the affected saline aquifer.



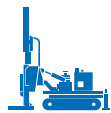
Timeline

PFAS Risk Mitigated with PlumeStop at Bulk Petroleum Storage Facility



- **May 2017**

Design and bid process takes place



- **January 2019**

PlumeStop pilot test begins



- **February 2019**

First post-injection sampling event is completed



- **December 2019**

Full-scale application implemented

Technology Used

PlumeStop Liquid Activated Carbon



PlumeStop is an *in situ* technology that rapidly reduces dissolved-phase plumes. PlumeStop behaves as a colloidal matrix binding to the aquifer matrix, rapidly removing contaminants from groundwater, and promotes permanent contaminant biodegradation. The benefit to PlumeStop's dispersive properties is its ability to sorb contaminants, quickly removing them from the mobile phase while providing a high surface area matrix which proves favorable for microbial colonization and growth.

Treatment

Successful Pilot Design Leads to Rapid and Effective Results

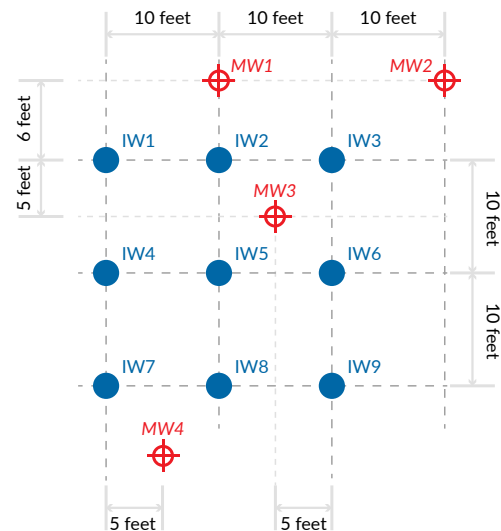
Site Details

Treatment Area	900 ft ²
Vertical Treatment Interval	3'-10' bgs.
Injection Wells	9
Soil Type	Sand
Gradient	Flat
Contaminants of Concern	PFAS and PHCs
Amendments Applied	2,024 lbs PlumeStop

REGENESIS and IRSL developed a pilot test design which included 9 injection points on a 10-foot injection grid. The use of direct push injection was considered, however due to the shallow nature of the treatment zone (3-10ft. BGS) and the presence of a hardpan near the surface, the progression of the injection tips was obstructed. To mitigate this issue, injection wells were drilled, thus allowing the further application of the PlumeStop injection. The application was completed within two days, under low pressure, to ensure that PlumeStop was emplaced within the flux zones of the aquifer to avoid the incidence of fractures within the subsurface.



Post-injection core samples like these were taken within the treatment area to identify the depth and extent of PlumeStop applications



Following the completion of the direct push injection, cores were taken within the treatment area to determine whether the colloidal activated carbon amendment had been effectively distributed at the appropriate levels and with the required radii of influence (ROI) to treat the contaminant influx avoiding untreated areas and pathways.

Groundwater validation was then completed in the monitoring wells within, up- and downgradient of the treatment area.

Results

PlumeStop Pilot Test Deemed Successful Leading to Full Scale Application



Post-injection cores confirmed PlumeStop distribution throughout the treatment area



All 14 PFAS compounds, including short chains, were reduced to ND within 6 weeks with maintained reductions through twelve months



Successful pilot test resulted in full scale treatment



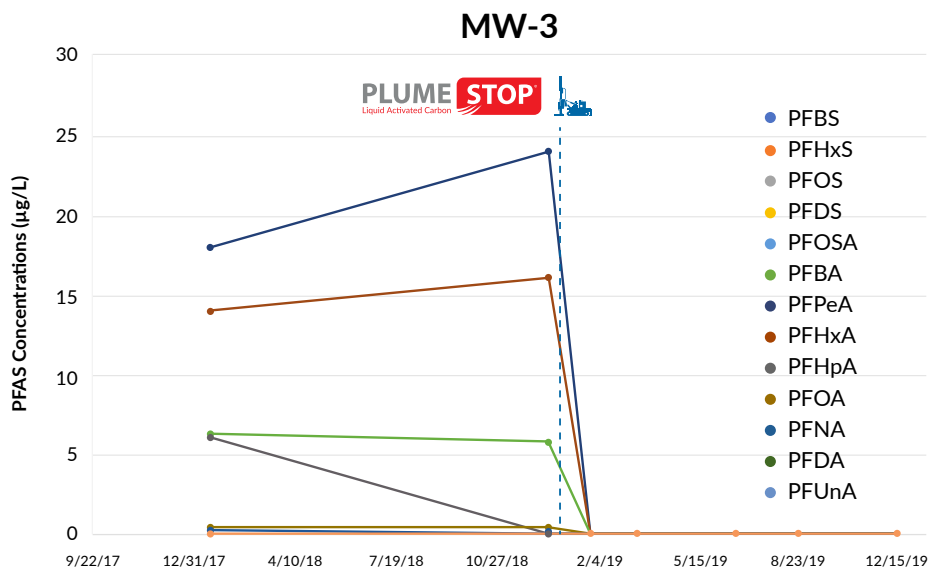
Modeling performed by IRSL suggests that this reduction will be maintained for over 30 years without the need for further re-injection

IRSL successfully injected over 2,000 lbs of Plumestop via 9 pre-installed injection wells. Post-injection soil cores indicated (as noted in MW-3 data below) that 94% of the samples collected contained PlumeStop within the targeted vertical interval. These efforts confirmed that the PlumeStop had been correctly installed within the contaminant flux zone.

A suite of 14 PFAS compounds were monitored at key performance wells MW-3 and MW-4. All PFAS compounds were reduced to non-detect (ND) within six weeks, maintaining ND reductions throughout the 12-month validation round. Short-chain (C4) PFAS compounds such as PFBA, which are known to be less easily sorbed and more mobile, were also entirely removed from the groundwater. In addition to PFAS, BTEX and MTBE were reduced below remedial objectives.

The salinity of the aquifer was also found not to be a hindrance to the efficacy of the remediation. The pilot study was deemed a success and full-scale treatment was implemented at the end of 2019.

PFAS constituents were effectively reduced to non-detect following the pilot study application of PlumeStop and have remained at these levels for twelve months post-application. Full-scale treatment consisting of PlumeStop injections in proximity to 3 former source areas was implemented in Dec 2019. Three month post-injection data indicated (<20ng/L) ND for all key performance wells.



Three month post-injection data indicated ND for all key performance wells.



The Consultant

About InSitu Remediation Services Ltd.



One of Canada's most experienced remediation companies, InSitu Remediation Services Ltd. (IRSL) has designed, implemented, and maintained soil and groundwater remediation programs in diverse geological environments in North, Central, and South America, Europe and the Middle East.

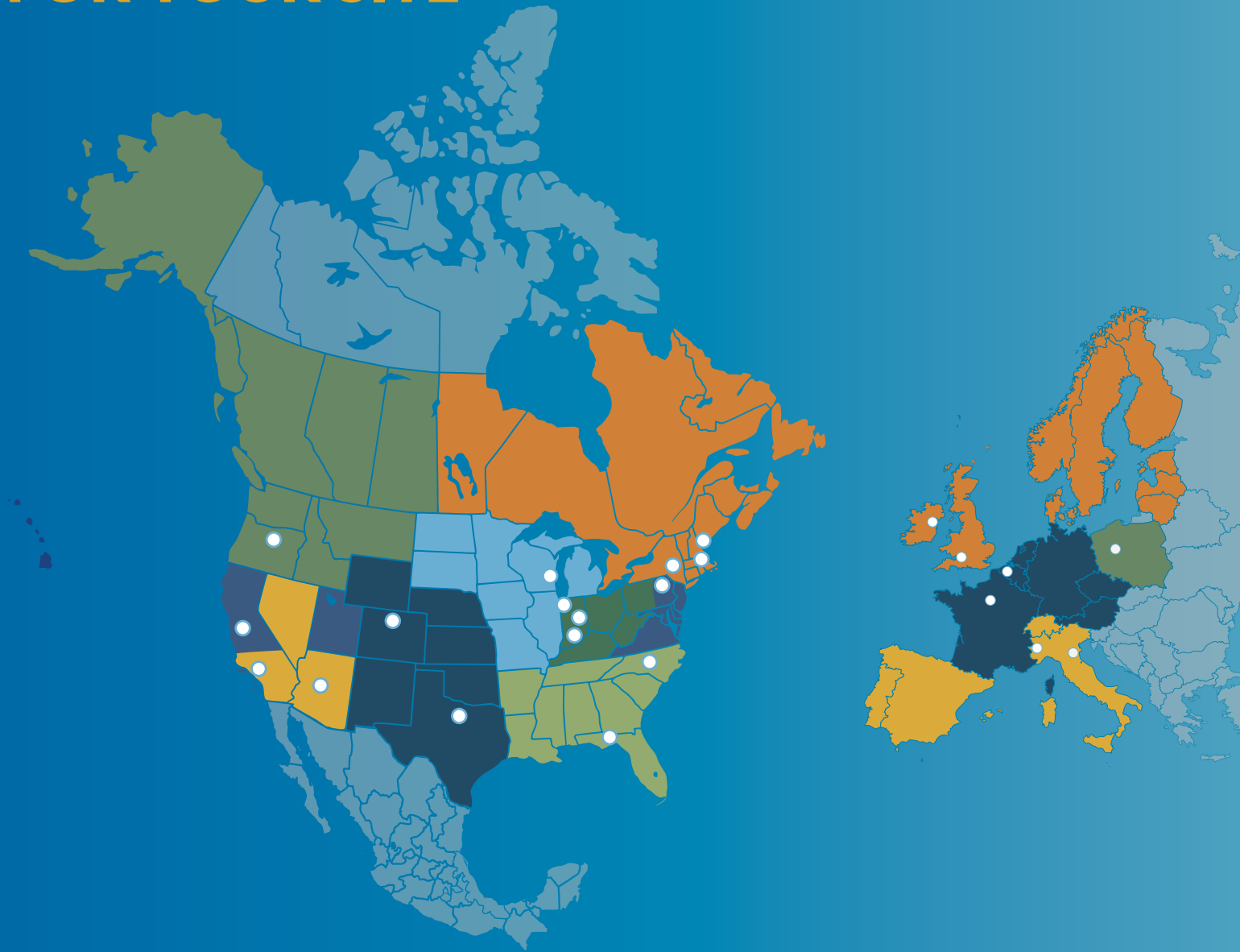
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Rick McGregor, President IRSL, Ltd.

Rick McGregor is the President of InSitu Remediation Services Ltd. with over 26 years' experience in groundwater and soil assessment and remediation. Rick has worked in over 30 countries and has authored numerous papers on groundwater assessment and remediation. Rick holds a M.Sc. from the University of Waterloo in hydrogeology and geochemistry and is a Certified Ground Water Professional in Canada and the United States.

WE'RE READY TO HELP YOU FIND THE RIGHT SOLUTION FOR YOUR SITE



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