

5 URGENT

Reasons for Remediation
Revealed by the Cost of Inaction
Linked to PFAS Exposure



Introduction

Per- and polyfluoroalkyl substances (PFAS) are a large class of man-made organic compounds that are common within a variety of consumer and industrial products. So common, in fact, that one or more PFAS contaminant compounds have been found in the blood of populations of people living in all industrialized countries.

PFAS are notable for their extraordinary persistence within the environment and high levels of mobility. They tend to spread widely via ground and surface waters and are expected to remain in the environment for hundreds, if not thousands of years because, by their very nature, they do not fully break down, even under harsh environmental stress.

PFAS contaminants, also known as 'Forever Chemicals,' have come under mounting scrutiny as human epidemiological studies have found startling associations between PFAS exposure and numerous health issues including hepatocellular damage affecting

“***‘The Cost of Inaction Linked to PFAS Exposure’ was released at the end of 2019 with the dual purposes of estimating the costs to society related to the negative effects and impacts on human health and the environment***”

liver function in adults, obesogenic effects in females, kidney cancer, low birthweight, reduced length of gestation, and reduced immune response to routine childhood immunizations.¹ A wide-ranging report from the Nordic Council of Ministers titled *The Cost of Inaction Linked to PFAS Exposure* was released at the end of 2019 with the dual purposes of estimating the costs to society related to the negative impacts on human health and the environment due to PFAS exposure as well as to highlight the economic case for taking effective and timely action to manage the risks posed by these negative impacts.²

What follows is a summary of the key findings from the Nordic Council's report as well as steps that may be taken in order to remediate the damage caused by PFAS in the environment. Although the study focuses

1. Grandjean P et al (2014). *Changing interpretation of human health risks from perfluorinated compounds*. Public health reports, vol. 129: (6). Pp. 482-485.

2. “The Cost of Inaction.” Nordic cooperation. Accessed May 5, 2020. <https://www.norden.org/en/publication/cost-inaction-0>.



on the costs of inaction with respect to regulation of PFAS in European Economic Area (EEA) countries, data for the report was gathered from examples of PFAS exposure worldwide, and the conclusions of the report are relevant to any country. There is no debate that PFAS is ubiquitous in the environment globally, and the costs to remediate PFAS contamination can be substantial. But if actions are not taken to limit PFAS emissions quickly then the costs to society will only continue to grow.

The Key Findings and Case Studies

The most impactful findings of the *Cost of Inaction* report come from a series of five individual case studies, each examining a different PFAS impact pathway or route to

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human or environmental exposure. By examining these case studies, it is possible to gain a solid understanding of where PFAS exposure is most likely to originate from and the impact it is likely to have in communities and ecosystems worldwide. Armed with this knowledge, actions can then be taken to mitigate the risks that PFAS poses.

#1

PFAS Emissions from Production Facilities are Ongoing and Continue to Impact Communities



“ Although measures to protect workers were employed as early as the 1970’s, measures to reduce emissions into the environment were not taken until much later. ”

The Impact of PFAS to Community Resources Worldwide is Far Reaching

The number of facilities continuing to actively produce fluorochemicals in Europe is relatively limited, with estimates reaching up to 20 facilities total. But these facilities remain significant contributors to PFAS exposure via air, waterways, and soil. Workers at these facilities sustain high levels of potentially harmful exposure, and residents in nearby communities are often affected as well. The *Cost of Inaction* report highlighted various instances of PFAS exposure related to production along with associated costs over the course of the past several decades up to today.

First commercially introduced and manufactured in the US, PFAS, specifically perfluorooctanoic acid (PFOA) was also licensed to be used in a wide range of products throughout the world. Although measures to protect workers were employed as early as the 1970’s, measures to reduce emissions into the environment were not taken until much later. This has led to

significant contamination of local water supplies and other natural resources near production plants. As a result, a number of lawsuits have been settled or are ongoing in response to this history of environmental contamination linked to PFAS production sites. The funds from these lawsuits are planned for allocation toward a number of necessary environmental remediation efforts in affected communities.

Similar instances of contamination in Europe are highlighted in the report, including a site in the Netherlands which exposed an estimated 750,000 people in cities nearby to high levels of PFOA according to the Dutch government, along with a chemical company in Italy whose production directly affected groundwater, surface water, drinking water and land in an area of over 200 square kilometers according to the World Health Organization.³

3. WHO Europe (2016). *Keeping our water clean: The case of water contamination in the Veneto Region, Italy.*



In each of the highlighted cases, there were substantial costs levied on factory workers and local community members alike who faced PFAS exposure. Studies continue to be released implicating PFAS in the development of serious health issues such as a medical monitoring program funded by a 2004 settlement in West Virginia. The program concluded six illnesses were likely linked to PFOA exposure from a local production facility: kidney and testicular cancer, ulcerative colitis, thyroid disease, pregnancy-induced hypertension, and high cholesterol.⁴

Although levels of exposure vary based on production levels and environmental conditions in different locations, the need to reduce emissions and remediate known contaminated sites

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is shared worldwide by communities located in proximity to known production sites or former production sites. Those with concerns about their own local resources are encouraged to contact local representatives and explore options such as the low cost *in situ* remediation technologies proven effective in PFAS remediation that are offered by REGENESIS in the form of colloidal activated carbon, or PlumeStop®.

4. “Parkersburg, West Virginia.” *Per- and polyfluoroalkyl substances*, November 13, 2019. <https://pfasproject.com/parkersburg-west-virginia/>.

#2

PFAS Exposure can Come From the Production of Consumer Goods



PFAS have a wide variety of applications within the manufacturing of various consumer goods and other products including textiles, leathers, carpets, cleaning and car wash products, paints and varnishes, and various plastics.

PFAS Contaminants Are Found in a Wide Range of Products

PFAS have a wide variety of applications within the manufacturing of various consumer goods and other products including textiles, leathers, carpets, cleaning and car wash products, paints and varnishes, and various plastics. The production of these products is a known contributor to PFAS emissions into the environment, although quantifying the total emissions released may be impossible due to a lack of reporting by manufacturers. Exact figures are not necessary to understand that there is enough potential exposure to create serious long-term health risks.

For example, a car wash facility in the US was cited in the report as a source of PFAS contamination in local wells serving nearby towns. The surfactant properties of PFAS make them useful in car wash products and car waxes. Wells on the property of this particular facility had PFAS levels more than double the USEPA lifetime advisory levels causing the facility's owners to be required to take measures to prevent further contamination. With 79,000 car wash facilities known to be operating in Europe alone, many similar contaminated sites are likely to abound in communities across the globe.



“ High-end estimates concluded over 35,000 individual manufacturers in EEA countries have the potential for releasing a range of PFAS contaminants into the air, water, and soil... ”

In an attempt to quantify how prevalent PFAS contamination may be as a result of the production of these various types of goods, the report compiled a list of each product category and made the assumption that between 3% and 10% of the individual manufacturers within these industries have used or are using products containing PFAS contaminants in their manufacturing processes. High-end estimates concluded over 35,000 individual manufacturers in EEA countries have the potential for releasing a range of PFAS contaminants to air, water, and soil both during the manufacturing process as well as afterwards, in the form of industrial waste.

It is not unreasonable to extrapolate these findings from Europe to the rest of the world and conclude that there are similarly tens of thousands of manufacturers in the US and elsewhere responsible for harmful PFAS emissions into local environments. It is important to become aware of such industrial activities regionally and take the necessary steps to begin remediation, including identifying potential partners such as REGENESIS who have a track record of successfully addressing such issues on PFAS remediation sites globally.

#3

Airports and Fire Training Facilities Are At High Risk of Exposure



Groundwater, Soil And Surface Water Contamination Have Been Documented Near Airports, Military Bases And Fire Drill Sites In Multiple Countries

Aqueous film-forming foams (AFFFs) are a specific sub-type of firefighting foams that contain PFAS. These foams are highly effective in extinguishing petroleum-based fires and have been widely used around the world since the 1960s at both airports and fire training facilities. Pollution of groundwater and surface waters related to the use of AAFs in Europe is considered to be severe,⁵ and cases of groundwater, soil and surface water contamination have been documented near airports, military bases and fire drill sites in multiple countries.

“ One report suggests that many classes of PFAS are observed in groundwater at essentially every AFFF impacted site investigated to date. ”

In fact, one report suggests that many classes of PFAS are observed in groundwater at essentially every AFFF impacted site investigated to date.⁶ The health and environmental risks of this potential contamination are enormous as data suggests there are a total of 455 civilian airports in Europe and an estimated 239 military airfields in EEA countries and Switzerland, all with the potential for PFAS exposure.

5. Eschauzier C et al. (2012). Dermal Penetrato potential of Perfluorootanoic Acid (PFOA) in Human and Mouse Skin, *Journal of Toxicology and Environmental Health, Part A*. 75:50-62.

6. Field J et al. (Report for Environmental Security Technology Certification Program-ESTCP) (2017). *FAQs Regarding PFASs Associated with AFFF at US Military Sites*, p: 8.



After More Than a Year, PFAS Remains at Non-Detect

PFAS REMAINS AT NON-DETECT FOR MORE THAN A YEAR

CASE STUDY:
**Michigan Dept. of Military and
Veteran Affairs Employs PlumeStop
Barrier at Grayling Army Airfield**



Working with a team of remediation experts such as REGENESIS in such scenarios can allow communities to prevent such contamination from spreading. At Camp Grayling Army Airfield in Crawford County, Michigan, PFAS was found commingled with a chlorinated solvent plume migrating toward the property boundary, posing a threat the nearby community. Working with the Michigan Department of Military and Veteran Affairs (MDMVA), REGENESIS quickly developed a cost-effective design targeting known contaminants in the area, and within 60 days post-application, PFAS levels in all treated areas reached non-detect. Thanks to PlumeStop®, the colloidal activated carbon solution that was deployed, PFAS levels have consistently remained at non-detect more than a year later. Such results are possible at other airports and military sites with a known history of AFFF use.

To learn more about how PlumeStop provided rapid and cost-effective treatment for PFAS contamination at this site, read the full case study [here](#).

#4

Use of PFAS-Treated Products Leads to Direct and Indirect Exposure



85% Of The Indirect Emissions Result From Losses During The Use And Disposal Of Products

The *Cost of Inaction* report further details three categories of consumer products where the use and eventual disposal of the products can lead to human exposure and releases into the environment. The product categories discussed in the report are PFAS-treated carpets, PFAS-treated food contact materials, and PFAS-containing cosmetic products. It was found that 85% of the indirect emissions of perfluorooctanesulfonyl fluoride (POSFs) result from losses during the use and disposal stages of the product lifecycle.⁷

Since carpets, food packaging, and cosmetics are so prevalent in everyday life, direct PFAS exposure is a major concern. PFAS used to treat carpets and rugs can form into tiny particulates

“ This study provides clear evidence that increased water treatment protocols are required to fully mitigate the risks associated with PFAS. ”

released and suspended in the air that humans can inhale. Ingestion is also common, especially among toddlers who spend more time on the ground than adults. PFAS are used by the paper industry to produce products that resist grease and water such as food packaging. End products may contain up to 1.5% PFAS by weight.⁸ This PFAS can leach into food, increasing dietary exposure in humans.⁹ Compostable food packaging may also be an additional source of contamination for soil and edible vegetables as PFAS-contaminated composts and related substances have been documented.¹⁰

7. Alexandre G. Paul et al. (2008). A First Global Production, Emission, And Environmental Inventory For Perfluorooctane Sulfonate. *Environmental Science & Technology* 2009 43 (2), 386-392.

8. UNEP/POPS/POPRC.9/INF/11 2013.

9. Begley TH et al. (2008). Migration of fluorochemical-paper additives from food-contact paper into foods and food simulants. *Food Additive and Contaminants: Part A* 25(3):384-390.

10. Fuchs Jacques G (FiBL) (2008). *Compost and digestate: sustainability, benefits, impacts for the environment and for plant production*.



Research in the area of PFAS in cosmetics remains limited compared to other product categories, but it is well-known that PFAS are used in various products such as sun screens, body lotions, makeup, and dental floss. Not only is direct skin contact a potential health risk with some of these products, when the product is washed off after use, an additional problem is created. Due to the compounds' extreme persistence, wastewater treatment is ineffective in removing it from waste streams once disposed of. A 2016 study for the Swedish Environmental Protection Agency concluded that the main transport route of PFAS from consumer use of these types of goods into the environment was via sewage treatment plants and waste management facilities.

“ It is well-known that PFAS is used in various products such as sun screens, body lotions, makeup and dental floss. ”

This study provides clear evidence that increased water treatment protocols are required to fully mitigate the risks associated with PFAS. The use of PlumeStop, a colloidal activated carbon technology from REGENESIS, is a solution specifically designed to treat the unique characteristics of PFAS contamination by effectively eliminating the risk of PFAS.

#5

The Risk Does Not Disappear When Products Enter the Landfill



PFAS Remains Even After The Initial Product Breaks Down

When PFAS-containing products reach the end of their useful life, they are discarded or, in some cases, recycled. Liquid products may be washed down a drain to flow into a sewer system and wastewater treatment plant. Solid articles may end up in landfills or incinerators, or be recycled for material reuse.

Although waste incineration operating at 1,000 degrees Celsius may be capable of destroying PFAS, such temperatures are not found in nature or even many incinerators.¹¹ In April 2020, Bennington College [released their findings](#) and [laboratory results](#) from recent regional soil and water sampling in the area surrounding an incineration plant. The results of this preliminary research suggest incineration is not breaking down these dangerous chemicals so much as redistributing them into nearby poor and working class neighborhoods.¹²

“Landfill and other such waste disposal centers are not typically equipped with adequate tools for properly dealing with a PFAS contamination.”

In landfills, PFAS remains even after the initial product breaks down, eventually being able to migrate into liquids in the landfill and leachate collection systems or directly into soil and groundwater.

Landfill and other such waste disposal centers are not typically equipped with adequate tools for properly dealing with a PFAS contamination. But proven solutions from an industry-leading remediation team of experts such as those at REGENESIS can be leveraged to handle such scenarios and prevent contamination from spreading further into community resources.

11. Lerner, Sharon. “Toxic PFAS Fallout Found Near Incinerator in Upstate New York.” *The Intercept*, April 28, 2020.

<https://theintercept.com/2020/04/28/toxic-pfas-afff-upstate-new-york/>.

12. “PFAS Levels in Soil and Water around Norlite Incinerator: Summary of Findings” Bennington College, April 27, 2020.

<https://theintercept.com/2020/04/28/toxic-pfas-afff-upstate-new-york/>.



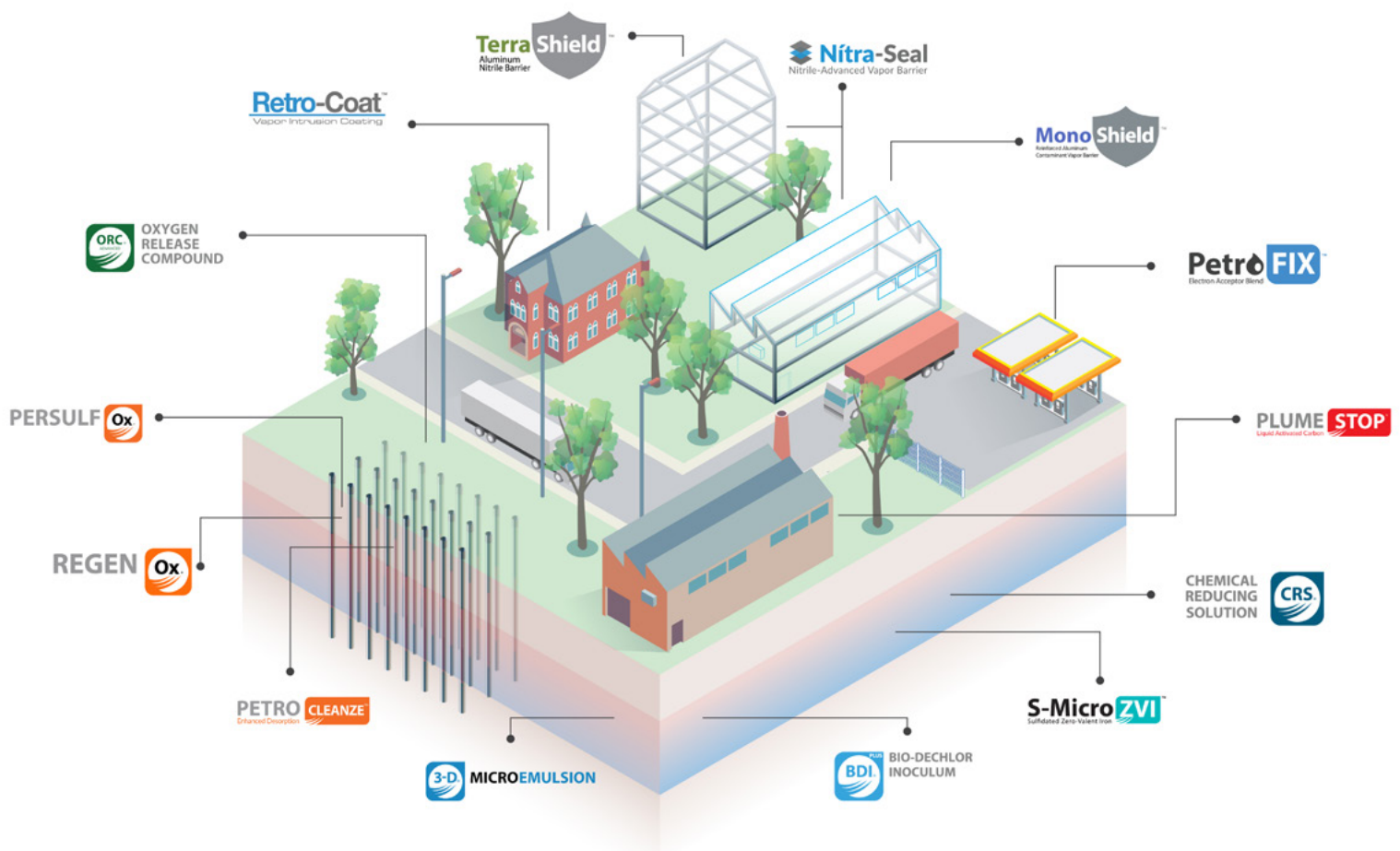
Conclusion

While *The Cost of Inaction Linked to PFAS Exposure* report was an effort at better understanding PFAS exposure in Europe, the key takeaways from the report are valuable for individuals all around the world because PFAS-containing products are common on every continent, and no population or ecosystem is immune to the potentially harmful effects of exposure.

Fortunately, there are remediation solutions available for communities that wish to mitigate their risk. REGENESIS has developed *in situ* remediation technologies, such as PlumeStop colloidal activated carbon, that are proven to effectively treat groundwater contaminated with PFAS without the excessive

“ **Fortunately, there are remediation solutions available for communities that wish to mitigate their risk** ”

complexity and costs associated with traditional pump and treat systems. The REGENESIS team of scientists and engineers is highly experienced at deploying easy-to-install PFAS remediation solutions at contamination sites around the world. Although such remediation solutions do come at a cost, the cost of inaction is certainly far greater.



About REGENESIS

At REGENESIS we value innovation, technology, expertise and people which together form the unique framework we operate in as an organization. We see innovation and technology as inseparably linked with one being born out of the other.

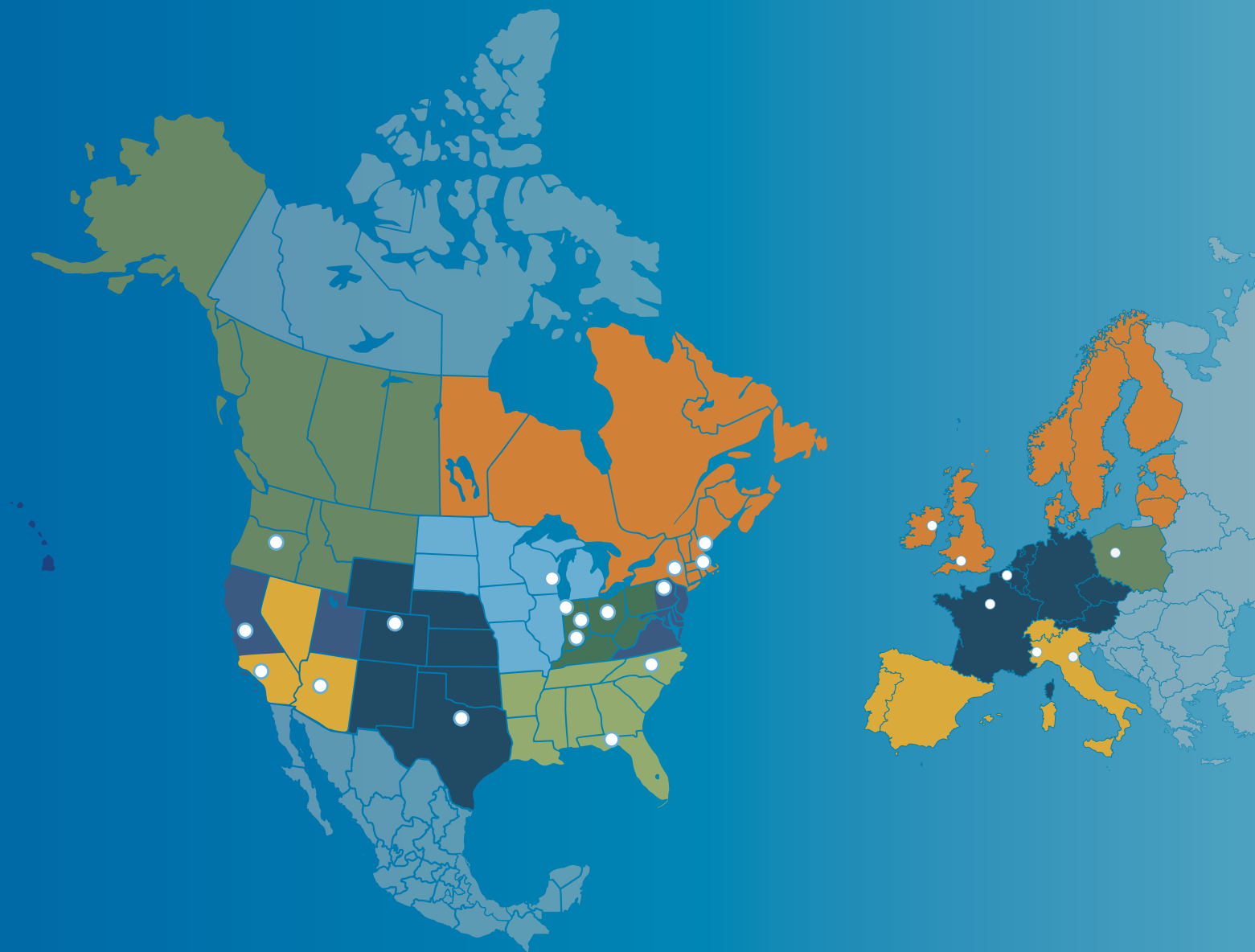
Inherently, innovation imparts new and better ways of thinking and doing. For us this means delivering expert environmental solutions in the form of the most advanced and effective technologies and services available today.

We value expertise, both our customers' and our own. We find that when our experienced staff collaborates directly with customers on complex problems there is a high potential for success including savings in time, resources and cost.

At REGENESIS we are driven by a strong sense of responsibility to the people charged with managing the complex environmental problems we encounter and to the people involved in developing and implementing our technology-based solutions. We are committed to investing in lasting relationships by taking time to understand the people we work with and their circumstances. We believe this is a key factor in achieving successful project outcomes.

We believe that by acting under this set of values, we can work with our customers to achieve a cleaner, healthier, and more prosperous world.

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



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