

Grant Number 1058239

SBIR Phase II: Investigation of the use of Chlorine Based Oxidants for Removal of Natural Organic Matter using Advanced Oxidation Processes

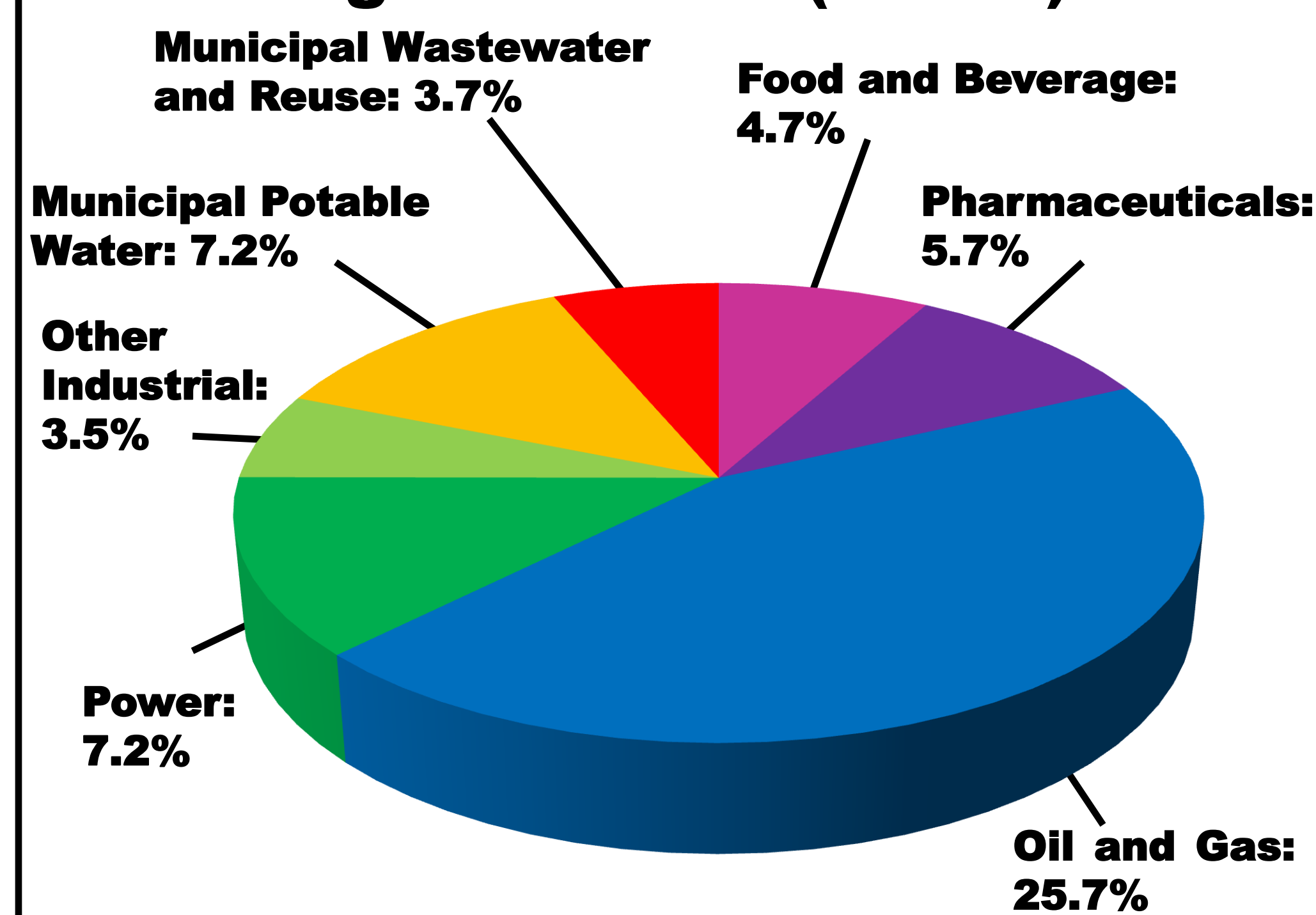
MIOX Corporation

Andrew K. Boal, Ph.D., PI

Commercial Impact

Chlorine-based Advanced Oxidation Processes (AOPs) will be deployed in applications where high purity water is desired.

Water treatment is currently a 23.5 billion per year market with an expected rapid compound annual growth rate (CAGR).



- Projected total CAPEX of nearly 50 billion USD by 2016
- Data from the 2011 Global Water Intelligence Report

Targeted Applications:

- Removal of Natural Organic Matter from surface waters to reduce the formation of organic disinfection by-products in distribution
- Removal of trace organics from water for potable, wastewater, and reuse water
- Removal of trace organics from water for food and beverage manufacturing
- Treatment of wastewater from industrial producers (pharmaceutical, oil and gas, semiconductor)



Market share for AOP technologies will likely increase at a higher CAGR as more industrial process water, aquifer recharge water, and even potable water comes from reuse sources.

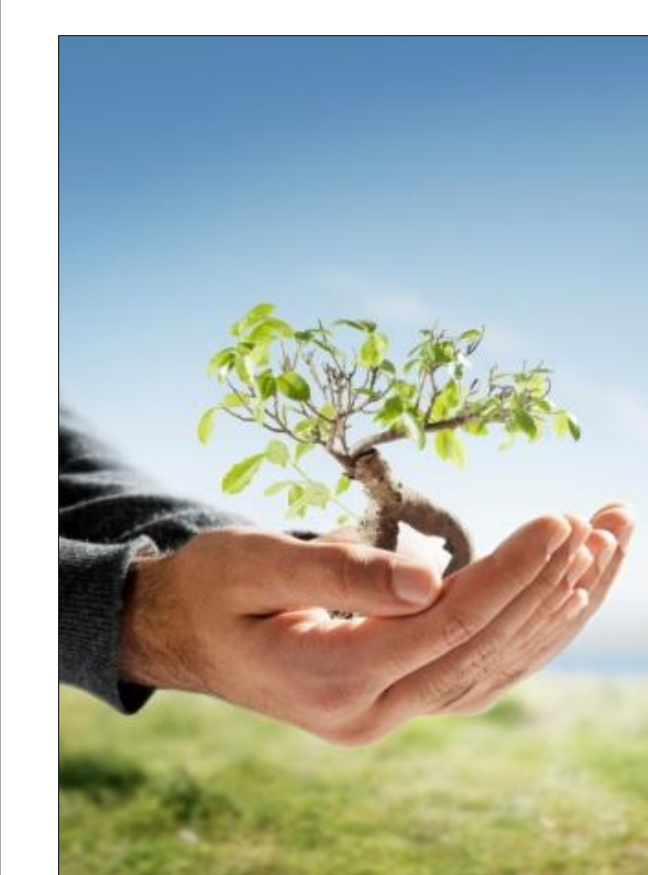
Product and Value Proposition

Ultimately, MIOX will develop a turn-key AOP package combining Mixed Oxidant Solution (MOS) generation with an ultraviolet (UV) light system for the removal of organic contaminants from water.



- Water contaminated with organic chemicals will be delivered to the MOS/UV AOP system
- Water will be dosed with MOS and then exposed with UV light to generate the AOP effect
- Purified water will then be available for potable, process, reuse, and other applications
- Depending on the application and overall treatment scheme, MOS/UV AOP will be integrated into the overall water treatment process.
- In applications requiring the addition of free available chlorine for residual disinfection, MOS/UV systems will be able to provide MOS for both the AOP and disinfection applications, thus providing additional savings to a customer.

MOS-AOP provides several benefits over traditional AOP technologies:



- Lower Chemical Costs:** Chemical costs of a MOS-AOP are expected to be at least ten times less than traditional hydrogen peroxide or ozone based AOPs.
- Lower Energy Costs:** Hydroxyl radical generation is more efficient from aqueous chlorine compared to hydrogen peroxide or ozone, so less UV is expected to be needed to produce an equivalent level of organic removal.
- Less Waste:** Hydrogen peroxide AOPs waste as much as 90% of the chemical added to the process, which must be removed after the AOP is complete, before the water can be used.
- Greener Process:** The above benefits, as well as those derived from on-site generation, lead to an overall greener alternative to Advanced Oxidation.

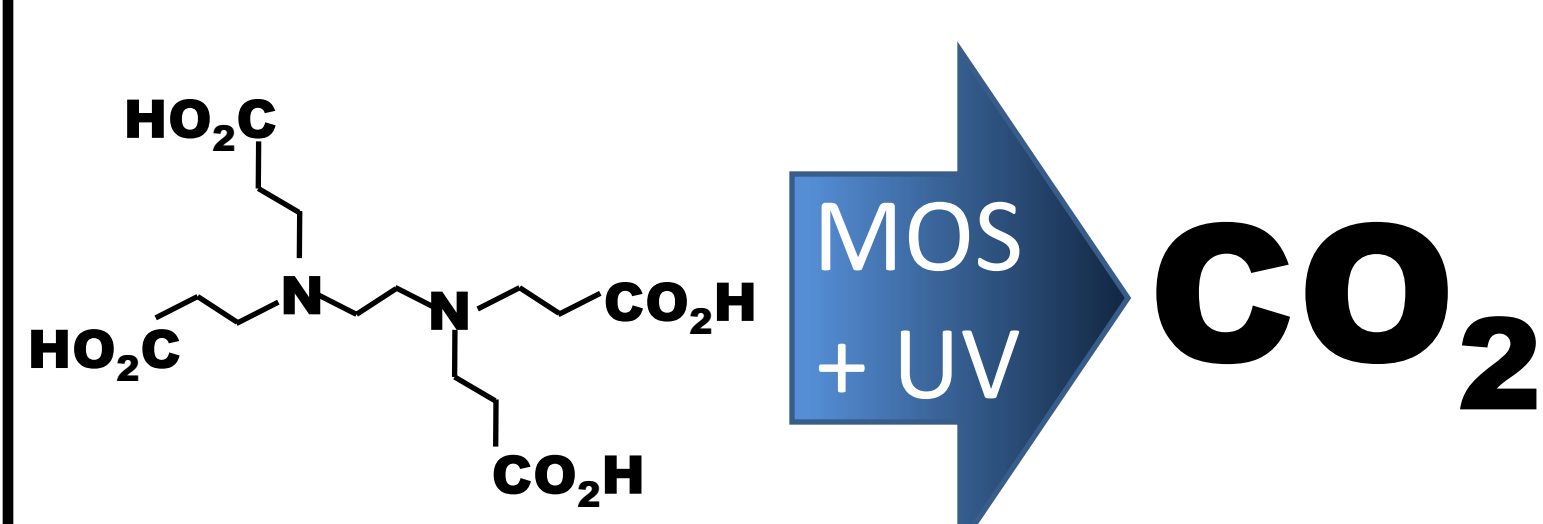
Technology Lineage

MIOX's main focus has been the development of improved on-site generation systems for the production of chlorine and MOS.



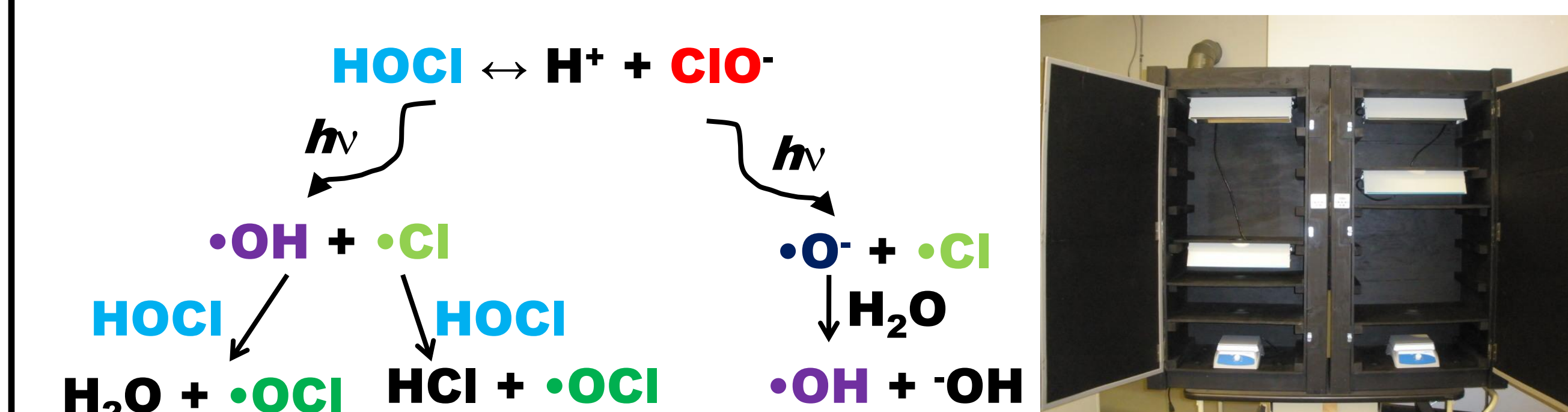
Beginning with some basic research in the late 1990s, MIOX has been investigating the application of MOS for AOPs.

- Early R&D demonstrated that MOS and UV light together are capable of removing small organics from water.



While early results were positive, the value proposition of the technology was not clear at the time.

- In 2010, MIOX initiated efforts to commercialize MOS-AOP technology through SBIR grants from the NSF.

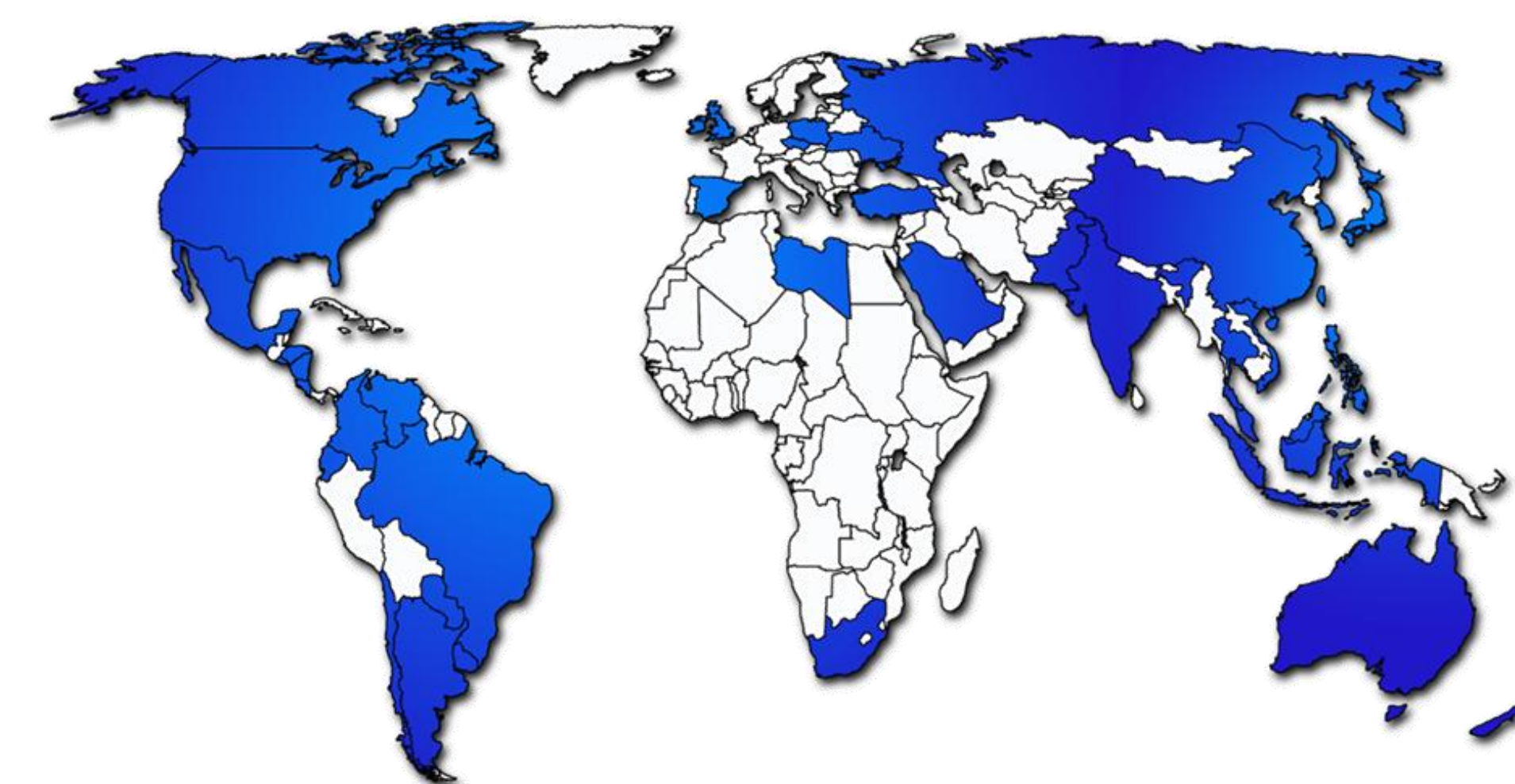


- Research is focused on demonstrating technology efficacy of organic removal, comparison to competitive technologies, and demonstration of the capability of the technology through field pilots.

Company and Team

MIOX Corporation was founded in 1994 as a spin-off from Los Alamos National Labs (LANL) to market on-site disinfectant generation technology developed by LANL for the US military.

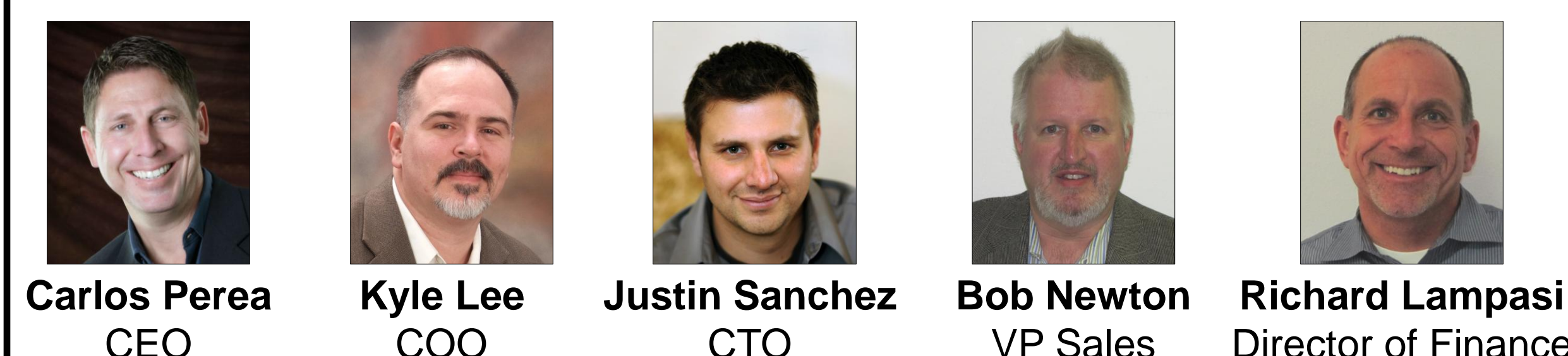
MIOX is a global water treatment company with over 1,500 installations worldwide.



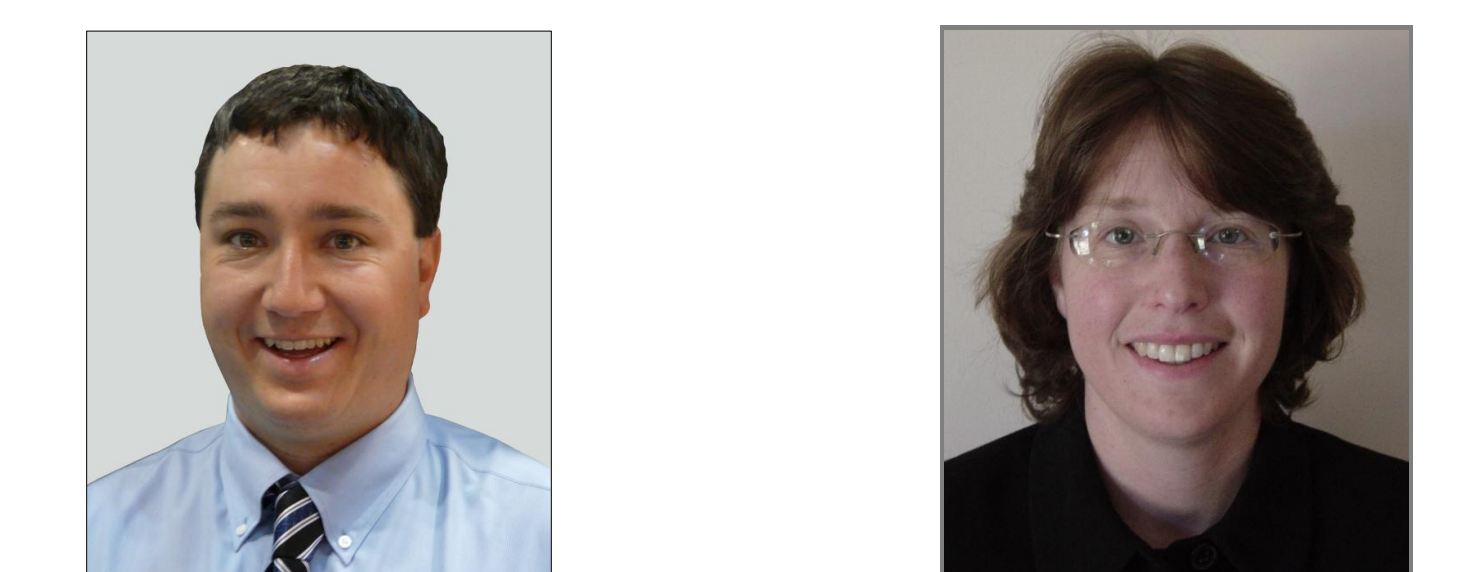
MIOX is a nationally recognized company.

- Between 2007 and 2010, MIOX launched three new product lines
- Winner of Frost & Sullivan's Award for Product Line Strategy 2010
- Winner of The Artemis Project's Top 50 Water Companies 2009, 2010
- Awarded Global Cleantech 100 Clean Technology Company - The Guardian & Cleantech Group, 2009
- Top 100 Winner of AlwaysOn DC Award 2009

MIOX Executive Team



SBIR Project Technical Team



Dr. Andrew K. Boal, PI
MIOX Corporation
Senior Scientist

Dr. Susan B. Rivera, Co-PI
MIOX Corporation
Manager, Research and Applications

Dr. Shane A. Snyder, Professor, University of Arizona

Dr. Benjamin D. Stanford, Director of Applied Research, Hazen and Sawyer, PC

Investors

