

**Senate Committee on Environment and Public Works**

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***“Protecting America’s Water Treatment Facilities”***

**Testimony of:**

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**Introduction**

Chairman Barbara Boxer, Ranking Member James Inhofe, and distinguished Members of the Committee, thank you for inviting me here today. My name is Carlos Perea, and I am the CEO of MIOX Corporation, a company that has been solving water quality issues for approximately 20 years. Based in Albuquerque, New Mexico, MIOX manufactures on-site generators (OSGs) for water disinfection. Using just ordinary food grade quality salt, power, and water to produce a very powerful and effective, but very safe, chemical alternative to gas chlorine and commercial strength bleach, OSGs eliminate the security and safety hazards associated with transporting, handling, and storing potentially dangerous chemicals. With more than 1,500 OSG installations in hundreds of U.S. communities and over 30 countries, MIOX systems are treating more than 6.5 billion gallons of water per day, serving millions of people worldwide, including a recent series of cost-effective, easy-to-install OSG systems in the poverty-stricken state of Chiapas, Mexico, where poor water quality had been a staggering source of illness and death. On-site generation is safely used for potable water, wastewater and reuse, commercial swimming pools, on board military and cruise ships, cooling towers, food processing, the beverage industry, other commercial and industrial applications. MIOX technology was developed under a government contract at Los Alamos National Labs to create a portable water disinfection unit for use in any remote location. In addition, the technology was designed to achieve purification standards of Type II, highly contaminated water as defined by US Environmental Protection Agency (EPA).

Over the years, our science and technology teams have worked with numerous agencies to promote safe water treatment around the world in both remote and populated areas. These groups include the Pan American Health Organization (PAHO), the Centers for Disease Control and Prevention (CDC), the Department of Homeland Security (DHS), the World Health Organization (WHO) and other internationally-recognized scientists from institutions and universities. The hand-held purifier development is one of DARPA's success stories, and continues to serve our men and women in uniform.

Although MIOX is just one of many companies that have been manufacturing on-site generators since their inception in the 1970s, it is my privilege to be here today to share with you, on behalf of the industry, how on-site generation is a safe, economical, and effective water disinfection method that can significantly reduce security and safety risks at American water treatment facilities. OSG is a well-tested solution that can virtually eliminate the safety and security issues of concern. It does not have to cost more money or add burden to the treatment facilities and communities, and is fully compliant with current drinking water regulations.

But despite these compelling reasons to switch to on-site generation - a proven, affordable, readily available option - not all communities are adopting OSG, instead continuing to use traditional, more dangerous technologies. Some communities only adopt safer approaches after an accident or close call with the storage or transport of their hazardous chemicals, while others prefer a proactive stance, switching for safety, security, or environmental reasons. But most are not likely to change, at least not until they are prompted, despite the competitive cost comparisons to traditional forms of chlorination. They may not realize how easy it is to change, or how much they could save in operations costs. Or, more likely they are just too busy with day to day operations and other priorities. While many US communities are working hard to meet EPA drinking water standards, they may not have a clear understanding of how best to address risks and overall safety. Without responsible legislation, the rate of change will continue to be slow, leaving the majority of our communities vulnerable to accidents, or, worse, to deliberate acts of terrorism for years and decades to come.

### **The Basics of Water Disinfection**

Chemical disinfection of public drinking water supplies, started in the United States in 1908 with the use of chlorine, has been heralded by the US CDC as one of the 10 great public health

improvements of the twentieth century to control infectious diseases. This global water treatment practice is one component of the multi-barrier approach to water treatment that also includes source water protection, sedimentation, filtration, and maintaining the integrity of the distribution system. <sup>i</sup>

Disinfection of public water supplies as well as reused water and wastewater discharged to streams and lakes is required in the United States under provisions of the Safe Drinking Water Act and Clean Water Act. Some states have imposed additional requirements for disinfection. Disinfectant selection is central to the design and operation of drinking water, wastewater, and reuse systems. Our understanding of methods to safely deliver chlorine has significantly improved since 1908, when chlorine gas was the only option available.

Chlorine gas, bulk bleach (hypochlorite), and chloramines are commonly used to chlorinate water systems, but each of these technologies involves at least one hazardous chemical. The EPA and DHS are promoting safer chlorination alternatives to minimize the risks associated with hazardous chemicals during transport, storage, and use. Classified as an inherently safer technology, on-site generation significantly minimizes risks and satisfies the EPA distribution system chlorine residual requirement.

### **Gas Chlorination Imposes National Security and Safety Risks**

While chlorine gas has been used successfully for over 100 years to eliminate diseases in drinking water, it is a pressurized poisonous gas that causes serious injury and even death upon inhalation. In fact, chlorine gas was used as a chemical weapon during World War I and is heavily regulated by the EPA. Moreover, it is a potential terrorist target for release or theft of small cylinders. Worst case scenario risk assessments performed by utilities indicate that millions of people could perish if large quantities of gas were released in an urban area. Although the safety record for chlorine gas is admirable considering its rate of use, tragedies continue to occur daily with accidents at water treatment facilities, train or tanker truck wrecks, and other disasters that cause additional loss of life due to the toxic nature of the chemical.

### **Fundamentals of On-Site Generation**

With OSG, chlorine-based disinfectant is generated on site, on demand, using just salt, water and power, replacing the need to purchase, transport and store dangerous chemicals. Creating

disinfectant on site is cost effective and environmentally responsible, cutting back transportation requirements by up to 80%, reducing carbon emissions and fuel consumption, and eliminating the storage and disposal of chemical containers.

With an OSG system, a brine – salt and water - solution is passed through an electrical current to produce hypochlorite, or bleach, via electrolysis. The low-concentration disinfectant ( $\leq 0.8\%$ ) is collected in a storage tank and metered into the water stream on-demand. While on-site generators are also used industrially and commercially to provide disinfection for swimming pools, cooling towers, and sanitation for clean-in-place operations, the largest application of OSG technology is municipal drinking water disinfection. Many water municipalities are moving away from more traditional chlorine delivery systems such as chlorine gas, concentrated sodium hypochlorite, and bulk calcium hypochlorite, and turning instead to OSG systems as a safer, more cost-effective disinfection method that also has less environmental impact. For example, it is estimated that it takes one delivery of salt to produce the same amount of chlorine as five deliveries of 12.5% sodium hypochlorite – bulk bleach - solution. Using OSG reduces the carbon footprint of the plant because less fossil fuel is needed to supply the plant with disinfectant.

On-site generation is simple to adopt; systems can be retrofitted with no downtime to the plant operations and minimal training.

### **On-Site Generation (OSG) is an Inherently Safer Technology**

One of the biggest driving forces behind OSG systems is the need to provide safer technology and safer storage to communities throughout the world, without compromising production or quality. Since many water treatment facilities are located adjacent to day care centers, schools, subdivisions and businesses, safety is an important consideration. The OSG process used by MIOX and other companies eliminates the transportation, handling, and storage of hazardous water disinfection chemicals like chlorine gas and delivered concentrated bleach.

Many utilities have converted to purchasing bulk quantities of sodium hypochlorite in an effort to mitigate this hazard. In general, bulk sodium hypochlorite is considered to be safer, but it still poses the potential for a toxic release, particularly when spilled or inadvertently combined with other chemicals. Exposure to a heat source can cause spontaneous ignition.

In contrast to alternative disinfection methods, the safe on-site generation of hypochlorite uses only salt, water, and power as feed stocks. Neither the salt nor the hypochlorite produced is classified as hazardous by the regulatory agencies. On-site generation for municipal water treatment has an excellent safety record, with approximately 6,000 units, from a variety of manufacturers, installed worldwide.

Apple Valley, California, converted to OSG in 1996 after concerns with the hazards of caustic 12.5% bulk bleach drove them to seek a safer alternative. “Before switching to on-site generation,” reported Mark Beppu, Control and Instrumentation Technician at Apple Valley, “we literally had to have a portable shower at every site. Transferring the liquid bleach with a tube was a slippery mess and we were all geared up in full face shields, goggles, aprons - the works - every time. When we switched to on-site, we were given proper training, installation was problem-free, and we didn’t need any special equipment or gear. The salt was easy to get, totally safe, and we saw a huge cost savings. The run times vary by location, but a typical unit runs about 2.5-3 hours a day and makes a bunch of disinfectant.”

### ***Improved Operator Safety***

In addition to the broad-range security risks posed by gas chlorination, they also pose a variety of hazards to the operator. Chlorine gas is probably the most hazardous source of chlorine used by water treatments plants; it is toxic and the use of chlorine gas cylinders also poses a pressure hazard. Industrial strength bleach used for water disinfection is a 12.5 percent-by-weight solution, which is caustic. OSG systems use only water and salt and produce nonhazardous oxidant solutions with a chlorine content that typically contains less than 0.8 percent free available chlorine. Treatment plants that use OSG systems typically have to face less oversight from state health agencies, provide less safety training for operators, and have less of an insurance issue compared to those using traditional forms of chlorine.

### **On-Site Generation is Cost-Effective**

Because it is unnecessary to continuously purchase expensive chlorine chemicals, on-site generators typically produce chlorine at a much lower cost than traditional delivery methods. Additional savings are also realized by decreased safety-related and transportation costs,

including possible lower insurance premiums. Although OSG systems may present a significant up-front capital equipment cost, many water plants realize a return on their investment in OSG equipment within two to three years.

Recently, the Lakehaven Utility District, located between Seattle and Tacoma, installed a new MIOX on-site generator, replacing the gas chlorine and bulk bleach currently employed. The Lakehaven Board of Commissioners voted to upgrade the facility to a MIOX on-site generator based on safety and cost efficiencies. A capital lease program allowed Lakehaven to improve their facility at less cost to the utility than a capital equipment purchase or the monthly cost of chemicals.

“Switching to MIOX was a carefully considered decision,” said Chris McCalib, wastewater operations manager, Lakehaven Utility District. “We knew we needed to address the potential costs and complications associated with process safety management if we were to continue to use gaseous chlorine. At the same time, we had microbiological issues that we needed to address, particularly filamentous bacteria in the secondary treatment system. It made sense to go with on-site generation for safety and cost benefits, and after careful scrutiny and evaluation, we chose MIOX because of their excellent safety record and the superior effectiveness...”

***Cost Comparison with Other Chlorine Technologies*** The cost of operating an on-site generation system depends on the cost of salt and power. In general, the lifecycle cost of on-site generation is very competitive with chlorine gas alternatives, and is typically less than delivered hypochlorite and the advanced disinfection technologies of chlorine dioxide, ozone and UV.

Maintenance needs are nominal, particularly for systems using good quality salt. In addition, the elimination of hazardous chemicals translates into reductions in regulatory paperwork, safety training requirements, safety inspections, and liability exposure.

***Transportation Costs*** The cost of freight significantly impacts the daily costs of chemical disinfectants. Given that the OSG process only utilizes salt, power and water, the freight costs are far less. Many more deliveries of bulk bleach are required for the same chlorine equivalent generated by a single delivery of salt.

As fuel costs rise, this variable becomes even more influential. Rises in the cost of fuel and subsequent rises in freight equate to a significant increase in the cost of bulk bleach.

### ***High Quality Chemicals***

Since hypochlorite quality degrades during time in storage, older hypochlorite contains progressively less free available chlorine, becoming less effective. Degradation of the product can become an issue in areas that are required to have 30-day or higher supplies of disinfectant chemicals on hand. OSG systems, on the other hand, typically produce only a two- to three-day supply of chlorine at a time, thus providing a potent disinfectant. Salt does not decompose, so that long-term requirements can be met by storing enough salt to comply with regulations. This is especially important for smaller, rural communities that purchase larger quantities of bulk bleach to save money up front, then find that the degradation of the product in storage is only a percentage of its original strength. This can create problems with dosing to meet regulations and is avoided when fresh OSG solutions are used.

### **On-Site Generation is a Proven Disinfection Method**

On-site generation is not a new and innovative technology; it has been disinfecting water for decades. Collectively, OSG providers, including MIOX, have well over 5,000 installations worldwide, including many systems that have been employed for over 10 years. For example,

#### ***City of Bloomfield, New Mexico***

#### ***Commissioned 1998, 2.7 MGD***

The water treatment plant for the City of Bloomfield, New Mexico, with a population of just over 6,000, had been disinfecting their water using gas chlorine stored in 1-ton cylinders, then injected into the water stream to disinfect. OSHA requires submittal of a Process Safety Management (PSM) plan for over 1,500 pounds of chlorine stored on-site, while EPA requires a Risk Management Plan (RMP) for 2,500 pounds stored on-site. Since the MIOX solution produces disinfectant as needed, and the concentration is so dilute, regulatory paperwork was reduced or eliminated.

***Cedar Knox Rural Water Project, Nebraska***

***Commissioned 2000, 300,000 -700,000 gallons per day***

Before 2000, the rural community of Cedar Knox – with just over 1,000 residents – had been using gas chlorine to treat its water system. Operators had to transport 150-pound chlorine gas cylinders from the office-warehouse building 45 miles to the treatment plant via pick-up truck. The last 8½ miles were over graveled country roads that could be difficult to travel, especially in inclement weather. By switching to on-site generation, employees only had to transport harmless food-quality grade salt, without the safety and security concerns associated with having hazardous chemicals at the plant.

***City of Las Vegas, New Mexico***

***Commissioned 2000, 3.5 MGD***

Situated 65 miles east of Santa Fe with a population of approximately 14,000, Las Vegas, NM required two one-ton chlorine gas cylinders totaling 4,000 pounds, putting them above the EPA limits for a Risk Management Program. Changing out the cylinders required two operators with full gas masks and air tanks and another person outside the chlorine room on standby. A fourth person would wait by the phone for a quicker response in the event of an accident. In contrast, on-site generation involves no hazardous chemicals whatsoever. According to the operators, “The safety aspect alone of MIOX would pretty much sell anybody.”

***City of Crossville, Tennessee***

***Commissioned 2000, 3.5 MGD***

The City of Crossville, Tennessee, located 110 miles east of Nashville, operates two water treatment plants that serve the City’s community of 11,500. In 1999, Crossville began investigating water disinfection methods in an effort to improve the safety of their plants, reduce the potential liability involved with using and storing gas chlorine, a hazardous and regulated chemical, and reduce disinfection byproducts (DBPs). Between the inherent safety risks involved with transportation of gas chlorine and stricter regulations imposed by the Risk Management Program and the Disinfection Byproducts Regulations, a section of the Safe Drinking Water Act, chlorine gas was no longer an

attractive water disinfection method.

Since 2000, MIOX reduced operational costs for the City of Crossville while eliminating the safety and liability issues involved with using chlorine gas. Crossville has recently upgraded to newer, more efficient MIOX OSG systems that have been running successfully since January 2009.

***North Table Mountain, Colorado***

***Commissioned 2000, 5 MGD***

North Table Mountain, with approximately 10,000 residents, was concerned both with public safety and plant personnel safety. An accidental release of chlorine gas meant possible harm to an operator or nearby residents, including large new subdivisions and a lake area across the street that is a popular destination for boaters and fishers. With on-site generation, the site no longer uses, produces, stores, or transports any hazardous materials. Liability has been reduced, the plant no longer has to maintain a Risk Management Program or file reports with the local fire department, and the operators no longer need to attend HAZMAT training or use safety equipment.

***Sangre de Cristo Water Company, Santa Fe, New Mexico***

***Commissioned 1998-2002, 3.5 MGD***

Capital of New Mexico and cultural hotspot, Santa Fe wanted to help secure the safety of their community and tourists by eliminating chlorine gas. The treatment plant stored 3 tons of chlorine gas at the plant. One well field stored 1-ton cylinders at the site, while five others had 150-lb. cylinders stored around the city in residential areas and commercial districts. Delivery trucks traveled up a very narrow residential road to the plant, which is above a heavily-touristed area. By switching to on-site generation in 1998, Santa Fe eliminated the need to transport, store, or handle chlorine gas, and is not required to develop an EPA Risk Management Plan or an OSHA Process Safety Management plan, and is no longer required to conduct HAZMAT training.

**Summary**

Today, we need to protect America's water treatment facilities. On-site generation is a proven method to do just that, economically and fully in compliance with current drinking water regulations. I believe the risks are real and are much more widespread than is often reported. We have all read about findings from the Department of Homeland Security that estimate how a single major chlorine gas spill in a urban area could kill 17,500 people, or about 6 times as many that died in the horrific attacks of September 11. Or another study done by a major insurance company that a rail spill of chlorine could cause over \$7 billion in damages, a catastrophe that would be in the unfortunate league of the current Gulf oil spill crisis.

While these figures are alarming, the reality is that this dangerous situation is not limited to urban areas and mass scale events. It is the smaller, rural communities that also have real danger from these toxic chemicals that are transported and stored as part of today's water treatment processes. In many respects, these smaller communities probably pose more of a danger given their numbers and the likelihood that they may not be resourced to take the same safety and security precautions as larger cities.

The best way to deal with these potential risks is to eliminate the need to store and transport these dangerous chemicals all together.

This approach:

- a) Is completely compliant with existing EPA drinking water standards;
- b) eliminates the need to store and transport hazardous chemicals altogether;
- c) saves money, typically achieving cost savings of 50% or more over the life of the equipment;
- d) is more environmentally responsible as one truckload of salt equals 5 trucks of delivered chemical and it eliminates the need to decontaminate used containers;
- e) is simple for existing users to adopt as systems can be retrofitted with no downtime and minimal training.

Moreover this approach is well tested with approximately 6,000 existing installations, many of which have been in service for 10 years or more and many of which are very small communities of 2,000 residents or less.

So, if these systems are safer and can save money, why aren't all communities following these examples and why should we consider additional regulations? I believe there are many reasons. Many of these communities are working hard to meet EPA drinking water standards. However, they have no clear signal on how much they need to focus on overall safety and risk. Some communities have only adopted these approaches after an accident or near miss with their hazardous chemicals. Others have adopted because they are proactive and want to take steps to be safer, lower cost and more environmentally responsible. But most are not likely to change, at least not until they are prompted. They may not realize how easy it is to change, or how much they could save in operations costs. Or, more likely they are just too busy with day to day operations and other priorities.

Whatever the reasons, I believe it is time we take steps to make our communities safe from these toxic chemicals. If we can make them safer and reduce their operational costs, why wouldn't we? I hope it doesn't take a tragic accident or deliberate act of terrorism for us to help the rest of the nation's communities and drinking water systems to take notice. Thank you for your consideration on this critical public concern.

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<sup>i</sup> Source: [www.awwa.org](http://www.awwa.org)