

Candidate Technology 14: Disinfection¹⁴

Technology Name	Shield 1500 (Puralytics)			
Technology Solution(s)	<input type="checkbox"/> Water Use Efficiency	<input checked="" type="checkbox"/> Increase Water Supply	<input checked="" type="checkbox"/> Reduce Use of Potable Water for Non-Potable Uses	<input type="checkbox"/> Water Management Tools
Sector(s)	<input type="checkbox"/> Agricultural	<input type="checkbox"/> Commercial	<input checked="" type="checkbox"/> Industrial	<input type="checkbox"/> Residential
Industry Segment(s)	Industrial: Manufacturing, Wastewater Treatment Facilities			
Drought Resilience	<input type="checkbox"/> High		<input checked="" type="checkbox"/> Medium	<input type="checkbox"/> Low
Water Benefits	<input type="checkbox"/> Reduces Water Use	<input checked="" type="checkbox"/> Increases Water Supply	<input checked="" type="checkbox"/> Produces/Uses Recycled Water	<input type="checkbox"/> Reduces Water Loss
Electric Benefits	<input checked="" type="checkbox"/> Energy Efficiency (Reduces kWh)	<input checked="" type="checkbox"/> Demand Response (Ability to Shift Load?)	<input checked="" type="checkbox"/> Distributed Generation (Increase Ability to Produce Clean Energy)	<input type="checkbox"/> Increase Energy Storage (Ability to Store Energy)
GHG Benefits	Yes.			
Implementation Timeline	<input checked="" type="checkbox"/> ≤ 3 years	<input type="checkbox"/> 3-7 years	<input type="checkbox"/> > 7 years	
Estimated Simple Payback	Cost not available to perform payback analysis.			

What is the technology?

The patented Puralytics® process employs LEDs to excite our proprietary nanotechnology mesh which drives light-activated treatment processes including an advanced oxidation process (AOP). The Shield achieves advanced disinfection, detoxification and contaminant degradation; it can be used in industrial treatment settings, manufacturing process or waste treatment. Emerging contaminants (personal care products & pharmaceuticals), herbicides and pesticides, pathogens (bacteria, virus, protozoa) and industrial chemicals (petrochemicals, toxins) are all destroyed in the treatment process. Multiple Shields may be used to achieve volume or treatment level requirements.

The unit is flexible in configuration, has a small footprint, and it is easy to integrate and operate. In addition, it has low pressure drop and minimal maintenance requirements. There are no chemicals additives and zero discharge. They are fully manufactured in the USA. Puralytics has developed a next generation advanced oxidation process, AOP PLUS, using only light energy to activate an advanced nanotechnology coated mesh. Water is purified through simultaneous photochemical reactions, destroying volatile organic chemicals, pesticides, pharmaceuticals; while also sterilizing bacteria, viruses, and other pathogens. There are no chemical additives and 100% of the water is purified.

¹⁴ Puralytics website: <https://puralytics.com/>.

How does it work?

Puralytics'® core technologies are advanced oxidation process (AOP) reactors using a proprietary catalyst material and light energy to generate hydroxyl radicals to purify water. The nanomaterial is not consumed or broken down, minimizing chemicals and eliminating water waste associated with traditional chemical and physical water treatment technologies. Contaminants are destroyed instead of concentrated, minimizing the disposal problems associated with traditional water treatment technologies. Conventional AOP technology was only developed four decades ago but is already widely used for destroying contaminants. The Puralytics version using photochemical oxidation, generates powerful hydroxyl radicals which are established to:

- Destroy volatile organic chemicals
- Destroy pesticides, pharmaceuticals and other chemicals
- Destroy or inactivate pathogens

The AOP PLUS also delivers additional oxidative power created through the Nano particle photocatalytic reaction used in the Puralytics AOP PLUS process. This higher level oxidative energy degrades additional hard to remove pollutants and contaminants which other AOPs and granular activated carbon cannot remove and can be used in to meet difficult to achieve regulatory or compliance standards for a wide range of pollutants.

The light and nanomaterial combine 5 photochemical processes delivering: disinfection, trapping of heavy metals through adsorption, breaking apart organic contaminants. Puralytics treatment modules or stand-alone systems are scalable in treatment level and in flow, from millions of gallons per day to less than 1 gallon per minute.

What are the benefits?

Database Field	Shield 1500 Puralytics Disinfection
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Sector	Commercial, Industrial, Residential
Industry Segment	Commercial: Healthcare Facilities Industrial: Wastewater Facilities, Food and Beverage Processing, Bioscience, and Research Laboratories
Water Benefits	<u>Level of Drought Resilience:</u> Medium
	<u>Type of Drought Benefit:</u> <ul style="list-style-type: none"> • Increases Water Supply • Produces/Uses Recycled Water
Water Resources	<u>Type of Water Resource Benefit:</u> <ul style="list-style-type: none"> • Because potable water is produced, there is less demand for potable water used for both potable and non-potable settings. • Water Recovery: 100% • Water Production: 0.5-3.9 L/min 200–1500 gallons per day 0.3- 1 GPM • Pressure Drop: 2–7 psi @ 200-1500 gpd

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	<ul style="list-style-type: none"> The Shield is designed to last 1 yr. or 547,500 gallons (2,072,512 Liters) with continuous operation before cartridge replacement is recommended.
Electric Benefits	<ul style="list-style-type: none"> Electricity Power Consumption: 570 Watts Electricity Savings: The technology produces up to 1500 gallons of water per day. It has 33% lower unit energy use. Other Enhancements Include: lower pretreatment requirements and active electronics cooling system to allow operation in hotter environments. Finally, it is compatible with much broader pumping options (for off-grid applications) and it has 150% higher flow capacity but similar performance on most contaminants.
Cost-Benefit Analysis	<ul style="list-style-type: none"> Cost not available to perform cost-benefit analysis.
Other Benefits: Health and Safety	<ul style="list-style-type: none"> Safe: UVA Wavelengths used are safe and avoid bromate and nitrite formation Sustainable: No Mercury UV lamps to replace (or break) each year Secure: No chemicals needed, simple cartridge replacement The Shield was designed to achieve 99.9999% bacteria, 99.99% virus, 99.9% protozoa, and > 70% reduction in any specific organic or heavy metal at 3.94 lpm (specifically, the microbiological targets are zero units found in standard tests which start with the log values of the targeted removal). By adjusting the flow rate, the reduction rate can be increased or decreased for a specific contaminant type. Shield units can be operated in parallel to increase throughput or contaminant reduction.
Other Benefits: Environmental	<p><u>Reduces GHG Emissions</u></p> <ul style="list-style-type: none"> Simple: Without the complexity of other AOPs- chemical feed, pressurized ozone or hydrogen peroxide Small footprint 100% water recovery - no concentrated effluent or backflush stream. Absolutely chemical free processing. Destruction of contaminants in water means no contaminants wind up in a landfill or other waste stream.
Other Benefits: Economic	<ul style="list-style-type: none"> Scalable: Other AOPs are not simple or inexpensive systems. Up to 90% lower unit consumables cost and reduced maintenance time. Flexible configuration (modular and scalable) Easy integration and operation Minimal maintenance requirements